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Jarmila Kukalová-Peck

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L'arbre phylogénétique du règne animal (groupant les ordres et les catégories supérieures)

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A Phylogenetic Tree of the Animal Kingdom (Including Orders and Higher Categories)

L'arbre phylogénétique du règne animal (groupant les ordres et les catégories supérieures)

Jarmila Kukalová-Peck

Biographical Note

Dr. Jarmila Kukalová-Peck was associate professor in paleontology at Charles University, Prague, from 1966 to 1970. Born in Prague, she received her Ph.D. from Charles University in 1962, specializing in Paleozoic insects. In 1969 she was Alexander Agassiz Lecturer in Zoology at Harvard University, and since 1970 has been associated with the Department of Geology, Carleton University, Ottawa. Dr. Peck has published over thirty scientific papers, including studies on Palaeodictyoptera, Protelytroptera, Ephemeroptera, and other insect orders from localities in Europe, the United States and the U.S.S.R.

Introduction

As part of the program to redesign the public exhibits in the Victoria Memorial Building, Ottawa, Dr. Louis Lemieux, Director of the National Museum of Natural Sciences, and Dr. Arthur H. Clarke, Head of the Invertebrate Zoology Section, decided that a display of the phylogenetic tree of the animal kingdom would be the most effective way of illustrating the diversity of animal life. It was felt that the phylogeny should use the orders and higher categories of classification to show the evolutionary relationship of the groups in time, with as much accuracy as is possible given the present level of knowledge. After the display data had been gathered the decision was made to publish the separate phylogenetic schemes in a manual that could serve as a useful summary of the animal kingdom for college students and higher-level educators in biology and paleontology.

The users of this manual should be aware that phylogeny may be the subject of the most dramatic disagreements between specialists, and may undergo very abrupt changes because of differing interpretations of evolutionary trends. Consequently, there may exist many parallel or even drastically different schemes, and frequently only future investigations can determine which is the more correct. Moreover, the levels of knowledge of the various groups are very uneven. In some, the building of phylogenetic schemes is traditional, for example, in vertebrates. For many groups, however, the graphs presented here are the first ones that cover major categories and their ancestry. Since phylogeny, by definition, expresses the natural relationships of creatures, problematic groups such as conodonts or conulariids could not be included in the charts.

Although there are many compendia that supply data for phylogenetic study, it would not have been possible for one person to cover this vast subject in the time allotted without consulting specialists in many groups. The scientists listed below reviewed the charts and some of them provided me with additional references and information. I am greatly indebted to them for their courtesy and very much appreciate the suggestions they made. This is in no way meant to imply that they are responsible for the schemes published here. Any errors are mine, but I hope they will be considered with generosity in view of the ambitiousness of the project.

Protozoa:

Dr. F.T. Banner
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Dr. H. Tappan-Loeblich
University of California, Los Angeles

Dr. V. Pokorný
Charles University, Prague

Porifera:

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Queens College, Flushing, N.Y.

Archaeocyatha:

Dr. V.J. Okulitch
University of British Columbia, Vancouver

Coelenterata:

Dr. W.A. Oliver, Jr.
U.S. Geological Survey, Washington, D.C.

Mollusca—Stem Graph, Hyolitha, Scaphopoda, Gastropoda:

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U.S. Geological Survey, Washington, D.C.

"Amphineura":

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National Museum of Natural Sciences, Ottawa

Bivalvia:

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Nautiloidea:

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University of Toronto

Ammonoidea:

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Coleoidea:

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Reptilia:

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Mammalia:

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Dr. L. Van Valen

University of Chicago

Aves:

Dr. P. Brodkorb

University of Florida, Gainesville

Most of the data on geological occurrence were taken from the *Fossil Record* (Harland, ed., 1967) and the *Treatise on Invertebrate Paleontology* (Moore, ed., 1953-70). The phylogenetic data are based largely on Barnes (1968), Hyman (1940-67), Kaestner (1967, 1970), and the *Treatise on Invertebrate Paleontology*. There are various other smaller works listed in the bibliography that threw light on problems of phylogeny. Since I attempted to synthesize and incorporate the latest knowledge, many of the schemes presented here do not exactly correspond to anything published before. The above-named specialists, who so graciously reviewed parts of the work, contributed some new ideas and arrangements not yet published. By presenting them, however, I am not trying to "claim-jump" or take the credit. Nor should I be considered as a first authority for these schemes. The previously unpublished novelties can become firmly based only when the facts or ideas to substantiate them are presented by the various specialists. Until based on data or presentation of reasons, many portions of the phylogeny are, of course, the author's logical deductions or hypotheses.

The purpose of this report is threefold. It will permit a wider distribution of the data presented in the Hall of Animal Life in the Victoria Memorial Building; for serious zoology students it will serve as an up-to-date and complete synthesis of animal evolution and phylogeny in the higher categories; and, hopefully, it may stimulate further research by the contributing specialists as well as by others interested in these problems.

4 June 1972

Note biographique

Madame Jarmila Kukalová-Peck fut professeur adjoint de paléontologie à l'université Charles de Prague, de 1966 à 1970. Née à Prague, elle reçut son doctorat de l'université Charles en 1962 se spécialisant en entomologie du paléozoïque. En 1969, elle fut conférencière Alexander Agassiz en zoologie à l'université Harvard et depuis 1970, elle est attachée à la faculté de géologie de l'université Carleton d'Ottawa. Madame Peck a publié plus de trente articles scientifiques dont des études sur les paléodictyoptères, les protélytroptères, les éphéméroptères et certains autres ordres d'insectes d'Europe, des États-Unis et de l'U.R.S.S.

Introduction

Dans les cadres du programme de réaménagement des exhibits de l'édifice Victoria Memorial d'Ottawa, Messieurs Louis Lemieux, directeur du Musée national des Sciences naturelles, et Arthur H. Clarke, chef de la Division de la Zoologie des invertébrés, conçurent le projet d'illustrer la diversité de la vie animale en montrant l'arbre phylogénétique du règne animal. Ils retinrent la phylogénèse des ordres et des catégories supérieures pour démontrer le lien évolutionnel des groupes à travers le temps, le plus exactement possible étant donné l'état actuel des connaissances. Après avoir recueilli les données de base, on décida de publier séparément les tableaux phylogénétiques en un manuel qui résume les ramifications du règne animal à l'intention des étudiants et des professeurs de biologie et de paléontologie.

Les usagers doivent se rappeler que la phylogénèse est l'objet de nombreux désaccords entre les spécialistes et peut subir des changements brusques par suite d'interprétations divergentes des courants évolutionnels. En conséquence, il peut exister plusieurs systèmes parallèles ou même totalement différents et, dans bien des cas, seulement les recherches futures pourront établir la primauté d'un système sur les autres. D'autre part, l'état de nos connaissances des différents groupes est très inégal. Dans certains cas, comme chez les vertébrés, le schéma phylogénétique est traditionnel. Chez d'autres groupes, par ailleurs, les présents tableaux sont les premiers qu'on ait publiés sur leur classification et leur évolution. La phylogénèse traitant par définition des liens naturels des êtres, il était impossible d'inclure dans les tableaux certains groupes problématiques tels que les conodontes ou les conularides.

Même s'il existe un grand nombre d'abrégés qui fournissent les données de base des études phylogénétiques, il eût été impossible pour une seule personne de couvrir un sujet si vaste en si peu de temps sans consulter un grand nombre de spécialistes. Les scientifiques dont les noms apparaissent ci-dessous ont révisé les tableaux et certains d'entre eux m'ont fourni quantité de références et de renseignements. J'ai hautement apprécié leur courtoisie et j'ai largement profité des suggestions qu'ils m'ont faites. Je n'entends pas par là les rendre responsables des tableaux qui apparaissent dans le présent ouvrage. Les erreurs qu'on pourrait y trouver sont les miennes, mais à cause de ma témérité face au projet, j'ose espérer qu'on se montrera clément à mon égard.

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Tableau principal des mollusques, hyolithes, scaphopodes, gastéropodes

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Université de Chicago

Oiseaux:

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Université de la Floride, Gainesville

La plupart des données géologiques locales ou temporelles proviennent de *Fossil Record* (Harland, ed., 1967) et de *Treatise on Invertebrate Paleontology* (Moore, ed., 1953-70). Les renseignements phylogénétiques se fondent en grande partie sur Barnes (1968), Hyman (1940-67), Kaestner (1967, 1970), et sur *Treatise on Invertebrate Paleontology*. La bibliographie mentionne un certain nombre de travaux moins volumineux qui ont cependant servi à éclairer certains problèmes. Puisque le présent ouvrage veut opérer une synthèse et tenir compte des découvertes les plus récentes, plusieurs tableaux diffèrent de tout ce qui a été publié jusqu'ici dans le même domaine. Les spécialistes nommés qui ont si généreusement révisé plusieurs parties du travail ont contribué plusieurs idées nouvelles et suggéré des arrangements qu'on ne saurait retrouver dans aucune autre publication. Loin de moi la pensée d'usurper sur ces personnes ou de m'attribuer le mérite de ces innovations. Il ne faudrait pas non plus me croire l'autorité définitive en ces matières. Les nouveautés inédites que comporte l'ouvrage n'auront de fondement véritable que lorsque les travaux des spécialistes en auront vérifié le contenu. Jusqu'à ce qu'on ait démontré l'application réelle de ces notions, certaines parties de cette phylogénèse ne sont en définitive que les hypothèses et les déductions logiques de l'auteur.

Le présent ouvrage se fixe un triple but. Il veut assurer la dissémination de renseignements contenus dans la galerie de zoologie de l'édifice Victoria Memorial; en ce qui concerne les étudiants, il veut leur présenter une synthèse complète et à jour de l'évolution animale et de la phylogénèse des catégories supérieures; et finalement, il est à espérer qu'il stimule la recherche tant chez les spécialistes qui ont contribué à sa mise au point que chez les autres scientifiques qui s'intéressent au même sujet.

4 juin 1972

Note des éditeurs

Pour des raisons d'économie, les Musées nationaux du Canada n'ont pas cru bon de publier une version française intégrale du présent ouvrage. Les désignations taxonomiques latines ont l'avantage d'être universelles et sont intelligibles pour l'ensemble des scientifiques. Les frais d'édition auraient doublé pour reproduire la série de tableaux avec une nomenclature à terminaisons françaises. Nous avons jugé que la taxonomie latine suffisait, et qu'on ne nous tiendrait pas rigueur des quelques mots anglais qui subsistent, tels que *phylum, class, order,* etc., auxquels le lecteur pourra facilement substituer les équivalents français.

Au-delà du motif d'économie, l'adaptation d'un ouvrage tel que celui-ci multiplie le risque d'erreurs. L'avantage linguistique offre moins d'attrait si les renseignements sont moins sûrs. Nous nous excusons auprès des lecteurs et les prions de nous accorder leur indulgence.

Les notes et les explications nécessaires à la compréhension de l'ouvrage apparaissent en français et en anglais. Nous n'avons ménagé aucune peine pour assurer la qualité technique de cette publication et nous espérons que tous pourront en tirer profit.

Ottawa, juillet 1972

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Excluded Phyla / Embranchements exclus

List and geological occurrence of phyla so small or poorly known that phylogenetic diagrams have not been prepared.

Les renseignements sur la distribution géologique de certains embranchements sont si minces qu'on n'en a pas fait de tableau phylogénétique. C'est le cas des catégories ci-dessous.

Radiata	
Phylum Ctenophora	Rec
Protostomes Acoelomates	
Phylum Rhynchocoela	JurTith—Rec
Phylum Mesozoa	Rec
Phylum Platyhelminthes	Rec
Phylum Gnathostomulida*	Rec
Protostomes Pseudocoelomates	
Phylum Entoprocta	Rec
Phylum Acanthocephala	Rec
Phylum Nematomorpha	
Order Gordioida	TertEoc—Rec
Phylum Nematoda	
Order Rhabditida	TertOlig—Rec
Phylum Kinorhyncha	Rec
Phylum Gastrotricha	Rec
Phylum Rotifera	Rec
Protostomes Schizocoelomates	
Phylum Priapulida	Rec
Phylum Sipunculida	Camb M.Camb—Rec
Phylum Echiurida	Rec
Phylum Tardigrada	Rec
Phylum Pentastomida	Rec
Protostomes Lophophorate Coelomates	
Phylum Phoronida	Rec
Deuterostomes	
Phylum Chaetognatha	Camb M.Camb—Rec

*Conodontophorida (Camb M.Camb—CretTuron) are possibly an extinct class of Gnathostomulida.

Les conodontophoridés (Camb M.Camb—CretTuron) sont peut-être une classe éteinte de gnathostomulidés.

Abbreviations of Geological Divisions in the Charts
Abréviations des divisions géologiques apparaissant dans les tableaux

Quat	**Quaternary**
Holo	Holocene
Pleist	Pleistocene
Tert	**Tertiary**
Plioc	Pliocene
Mioc	Miocene
Olig	Oligocene
Eoc	Eocene
Paleoc	Paleocene
Dan	Danian
Cret	**Cretaceous**
Maestr	Maestrichtian
Campan	Campanian
Santon	Santonian
Coniac	Coniacian
Turon	Turonian
Cenom	Cenomanian
Alb	Albian
Apt	Aptian
Barrem	Barremian
Haut	Hauterivian
Valang	Valanginian
Berr	Berriasian
Jur	**Jurassic**
"Tith"	"Tithonian"
Kimm	Kimmeridgian
Oxf	Oxfordian
Call	Callovian
Bath	Bathonian
Bajoc	Bajocian
Toarc	Toarcian
Pliens	Pliensbachian
Sinem	Sinemurian
Hett	Hettangian
Trias	**Triassic**
Rhaet	Rhaetian
Nor	Norian
Carn	Carnian
Ladin	Ladinian
Anis	Anisian
Olenek	Olenekian
Induan	Induan

Perm	**Permian**
Dzhulf	Dzhulfian
Guad	Guadelupian
Leonard	Leonardian
Sakm	Sakmarian
Assel	Asselian
Carb	**Carboniferous***
U. Carb	Upper Carboniferous
Moscov	Moscovian
Bashk	Bashkirian
Namur	Namurian
Viséan	Viséan
Tourn	Tournaisian
Dev	**Devonian**
Famen	Famennian
Frasn	Frasnian
Givet	Givetian
Eifel	Eifelian
Ems	Emsian
Siegen	Siegenian
Gedinn	Gedinnian
Sil	**Silurian**
Ludl	Ludlovian
Wenl	Wenlockian
Lldov	Llandoverian
Ord	**Ordovician**
Ashg	Ashgillian
Carad	Caradocian
Lldeil	Llandeilian
Llvirn	Llanvirnian
Arenig	Arenigian
Tremad	Tremadocian
Camb	**Cambrian**
U. Camb	Upper Cambrian
M. Camb	Middle Cambrian
L. Camb	Lower Cambrian

* To relate the phylogenetic charts as closely as possible to the geological divisions used in the *Fossil Record*, European division names have been used for the Carboniferous period. The Tournaisian, Viséan and Namurian "A" of Europe correspond to the Mississippian of American stratigraphy, and the Pennsylvanian of America approximates the Bashkirian, Moscovian and Upper Carboniferous of Europe.

* Dans le but de relier les divisions des tableaux phylogénétiques le plus intimement possible à celles de *Fossil Record*, nous avons employé, pour le Carbonifère, les dénominations européennes. Le Tournaisien, le Viséen et le Namurien "A" d'Europe correspondent au Mississippien de la stratigraphie américaine alors que le Pennsylvanien d'Amérique se rapproche du Bashkirien, du Moscovien et du Carbonifère supérieur d'Europe.

List of the Charts / Liste des tableaux

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Plan de l'arbre phylogénétique
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4 Phylum Porifera
5 Phylum Archaeocyatha
6 Phylum Coelenterata
7 Phylum Mollusca Stem Graph
Ramifications principales
8 Phylum Mollusca Class Hyolitha Class Scaphopoda
9 Phylum Mollusca Class Bivalvia
10 Phylum Mollusca Class Gastropoda
11 Phylum Mollusca Class Cephalopoda
12 Phylum Annelida
13 Phylum Onychophora
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Ramifications principales
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19 Phylum Arthropoda Subphylum Tracheata
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21 Phylum Bryozoa
22 Phylum Brachiopoda
23 Phylum Echinodermata
24 Phylum Pogonophora
25 Phylum Hemichordata
26 Phylum Chordata Stem Graph Fish-like Vertebrates
Ramifications principales Vertébrés pisciformes
27 Phylum Chordata Class Amphibia
28 Phylum Chordata Class Reptilia
29 Phylum Chordata Class Aves
30 Phylum Chordata Class Mammalia

Chart 1 / Tableau n° 1

The entire phylogenetic tree, as seen from the side, with the time factor excluded. The categories are a mixture of superphyla, phyla, subphyla, and some classes. It is intended that the position of the categories in reference to each other snow general degrees of evolutionary relatedness.

Profil de l'arbre phylogénétique excluant le facteur temporel. Les catégories retenues sont les super-embranchements, les embranchements, les sous-embranchements et certaines classes. La position relative de chaque catégorie traduit le rapport évolutionnel qui les rattache l'une à l'autre.

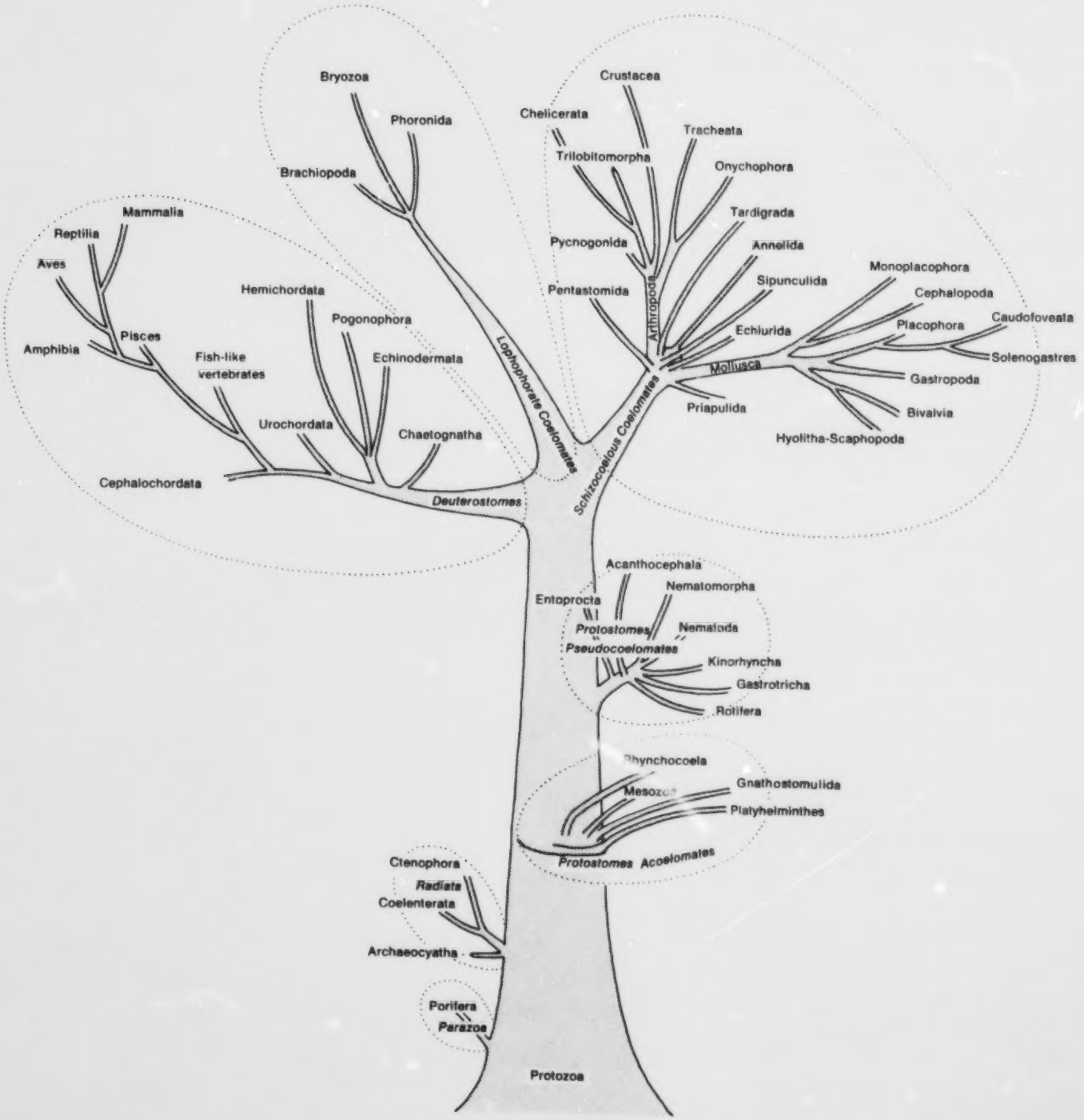

Bryozoa
Phoronida
Brachiopoda
Crustacea
Chelicerata
Tracheata
Trilobitomorpha
Onychophora
Tardigrada
Pycnogonida
Annelida
Pentastomida
Arthropoda
Sipunculida
Monoplacophora
Cephalopoda
Placophora
Caudofoveata
Echiurida
Solenogastres
Mollusca
Gastropoda
Priapulida
Bivalvia
Hyolitha-Scaphopoda
Mammalia
Reptilia
Aves
Hemichordata
Pogonophora
Pisces
Amphibia
Fish-like vertebrates
Echinodermata
Lophophorate Coelomates
Schizocoelous Coelomates
Urochordata
Chaetognatha
Cephalochordata
Deuterostomes
Acanthocephala
Nematomorpha
Entoprocta
Protostomes in Pseudocoelomates
Nematoda
Kinorhyncha
Gastrotricha
Rotifera
Rhynchocoela
Gnathostomulida
Mesozoa
Platyhelminthes
Protostomes Acoelomates
Ctenophora
Radiata
Coelenterata
Archaeocyatha
Porifera
Parazoa
Protozoa

Chart 2 Phylogenetic Tree, as seen from above
Tableau n° 2 Plan de l'arbre phylogénétique

Chart 2/Tableau n° 2

The entire phylogenetic tree, as seen from above, with the time factor excluded. The phyla are mostly in relationship to each other, and are grouped into superphyla. The phylum Gnathostomulida (an acoelous protostome) is not included.

Plan de l'arbre phylogénétique excluant le facteur temporel. Les embranchements sont presque tous en rapport successif et groupés en super-embranchements. L'embranchement des gnathostomulidés (protostomes dépourvus de coelome) est exclu.

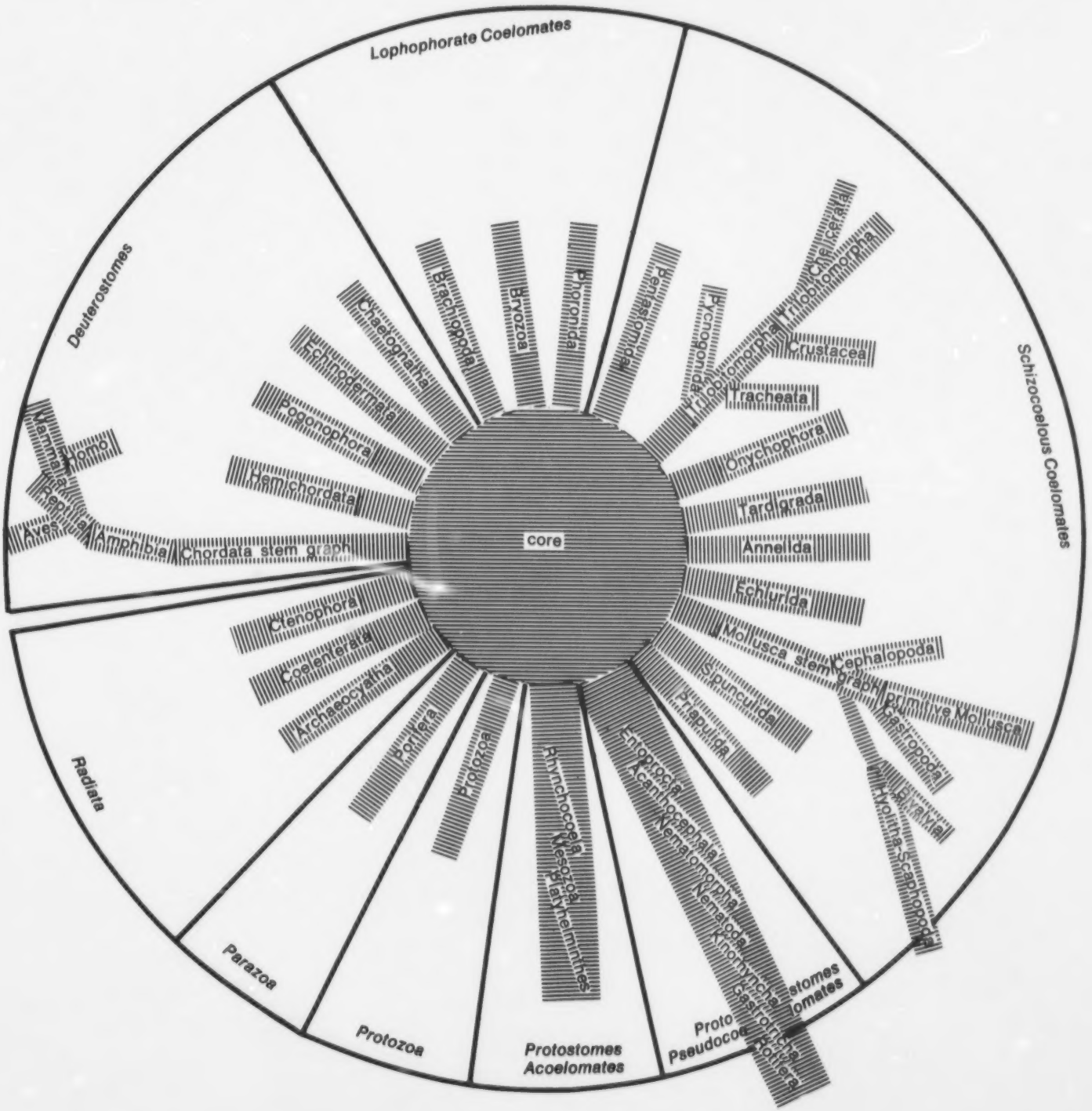

Lophophorate Coelomates
Schizocoelous Coelomates
Deuterostomes
Radiata
Parazoa
Protozoa
Protostomes
Acoelomates
Pseudocoe
core
Brachiopoda
Bryozoa
Phoronida
Pterobranchia
Pycnogonida
Trilobitomorpha
Chelicerata
Crustacea
Tracheata
Onychophora
Tardigrada
Annelida
Echiurida
Mollusca stem graph
Cephalopoda
primitive Mollusca
Gastropoda
Bivalvia
Hyolitha
Scaphopoda
Sipunculida
Priapulida
Entoprocta
Acanthocephala
Nematomorpha
Nematoda
Kinorhyncha
Gastrotricha
Rotifera
Rhynchocoela
Mesozoa
Platyhelminthes
Protozoa
Porifera
Archaeocyatha
Coelenterata
Ctenophora
Chaetognatha
Echinodermata
Pogonophora
Hemichordata
Chordata stem graph
Amphibia
Reptilia
Aves
Mammalia
Homo

Chart 3/Tableau n° 3 Phylum Protozoa

Chart 3/Tableau n° 3

Phylum Protozoa	
Subphylum Sarcomastigophora	
Superclass Mastigophora	Rec
Superclass Opalinata	Rec
(not included/exclue)	
Superclass Sarcodina	
Class Rhizopodea	
Subclass Lobosia	
Order Amoebida	QuatHolo
Order Arcellinida	CarbNamur—Rec
Subclass Filosia	
Order Aconchulinida	Rec
(not included/exclu)	
Order Gromiida	TertEoc—Rec
Subclass Granuloreticulosa	
Order Athalamida	QuatHolo
Order Foraminiferida	
Suborder Allogromiina	Camb U.Camb—Rec
Suborder Textulariina	Camb L.Camb—Re
Suborder Fusulinina	OrdAshg—TriasRhaet ?JurTith—CretBerr
Suborder Miliolina	SilLudl—Rec
Suborder Rotaliina	?CarbViséan PermGuad—Rec
Class Piroplasmea	Rec
(not included/exclue)	
Class Radiolaria	
Order Tripylea	TertMioc—Rec
Order Spumellaria	OrdLldeil—Rec
Order Nassellaria	TriasAnis—Rec
Class Acantharia	TertEoc—Rec
Class Heliozoa	QuatPleist—Rec
Class Proteomyxidia	Rec
(not included/exclue)	
Subphylum Sporozoa	Rec
Subphylum Cnidospora	Rec
Subphylum Ciliophora	
Class Ciliatea	Rec
Subclass Holotrichia	Rec
Subclass Spirotrichia	
Order Heterotrichida	TertDan—Rec
Order Tintinnida	OrdAshg—Rec
Order Hypotrichida	TertEoc—Rec
(Other orders not included/ Les autres ordres sont exclus)	

Phylum Protozoa

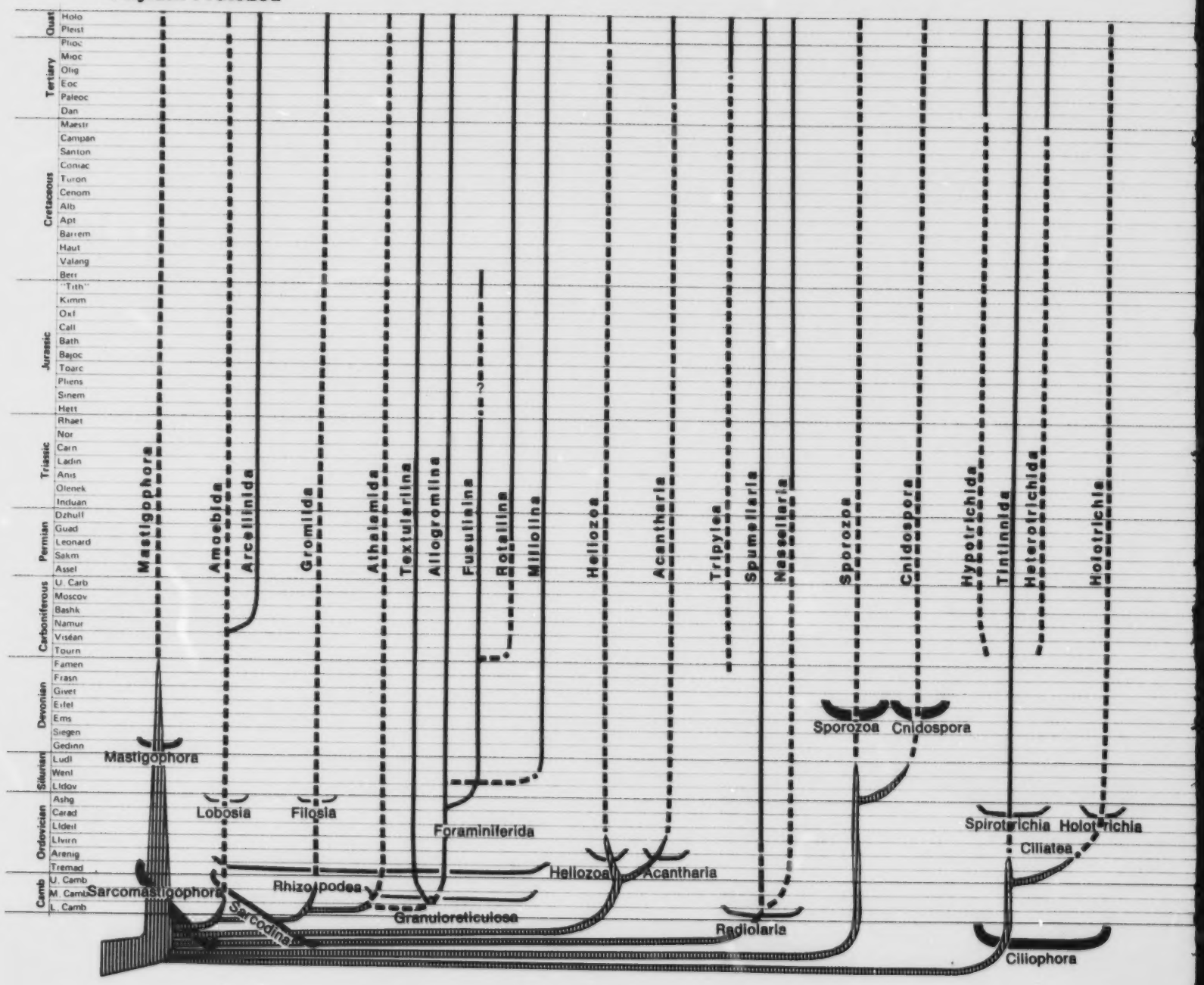


Chart 4/Tableau n° 4 Phylum Porifera

Chart 4/Tableau n° 4

Phylum Porifera	
Class Hexactinellida	
Order Amphidiscophora	Carb U.Carb—Rec
Order Hexasterophora	Camb L.Camb—Rec
Class Demospongia	
Order Keratosa	Rec
Order Monaxonida	Camb M.Camb—Rec
Order Lithistida	OrdArenig—Rec
Order Choristida	CarbViséan—Rec
Class Heteractinida	Camb L.Camb—PermLeonard
Class Calcarea	
Order Sphinctozoa	CarbBashk—CretMaestr
Order Pharetrones	PermSakm—Rec
Order Calcinea	Rec
Order Calcaronea	CarbViséan—Rec

Phylum Porifera

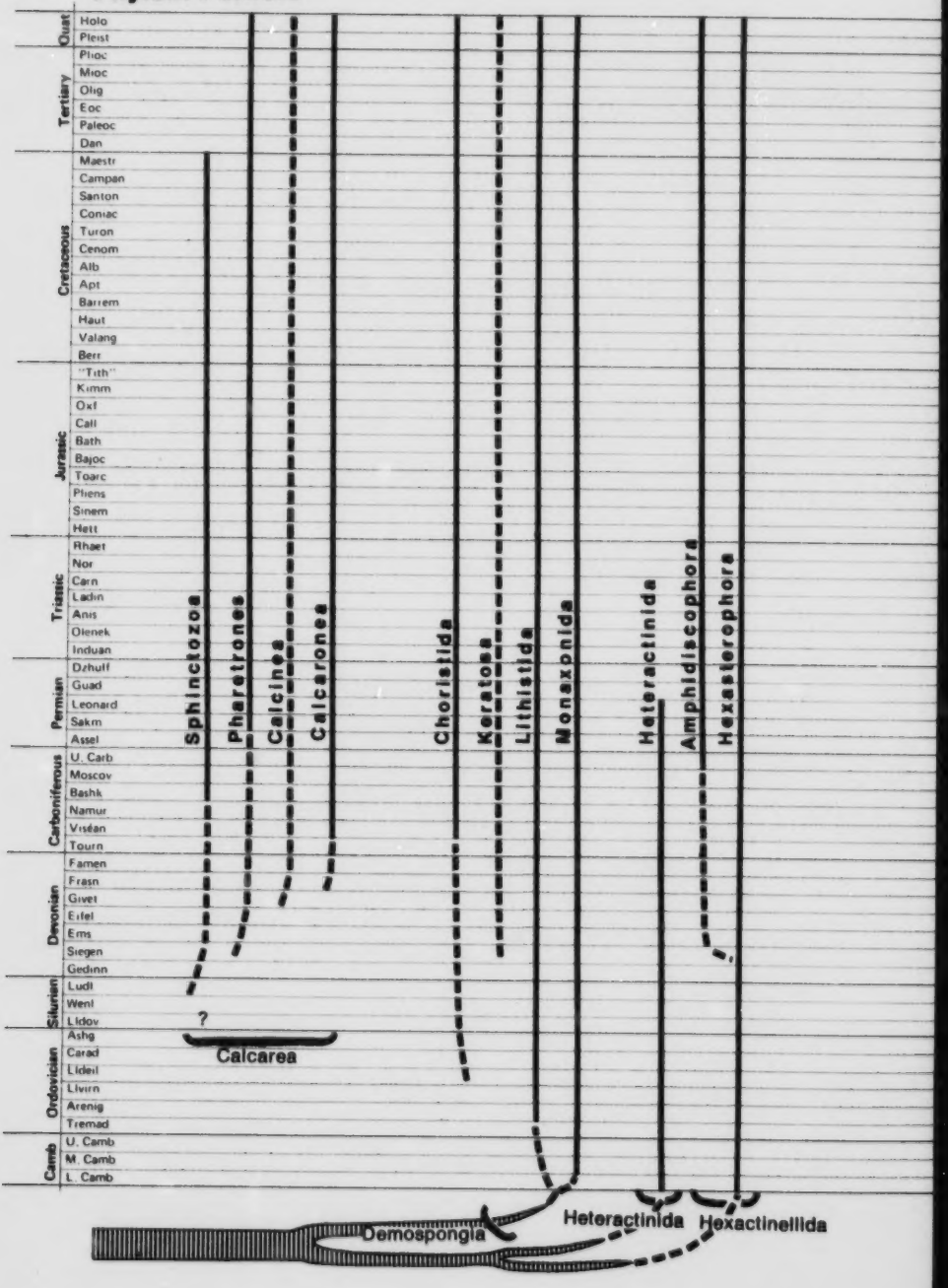


Chart 5/Tableau n° 5 Phylum Archaeocyatha

Chart 5/Tableau n° 5

Phylum Archaeocyatha

Class Regulares	
Order Monocyathida	Camb L.Camb
Order Ajacicyathida	Camb L.Camb
Order Coscinocyathida	Camb L.Camb
Class Irregulares	
Order Archaeocyathida	Camb L.Camb
Order Syringocyathida	Camb L.Camb
Order Rhizacyathida	Camb L.Camb

D. Hill (*in* Curt Teichert, ed., *Treatise on invertebrate paleontology,* pt. E, vol. 1: *Archaeocyatha,* rev. ed., 1972, 158 pp.) has recently proposed a different system.

D. Hill (dans Curt Teichert, éd. resp., *Treatise on invertebrate paleontology,* partie E, vol. 1: *Archaeocyatha,* éd. rév., 1972, 158 p.) a récemment proposé un système différent.

Phylum Archaeocyatha

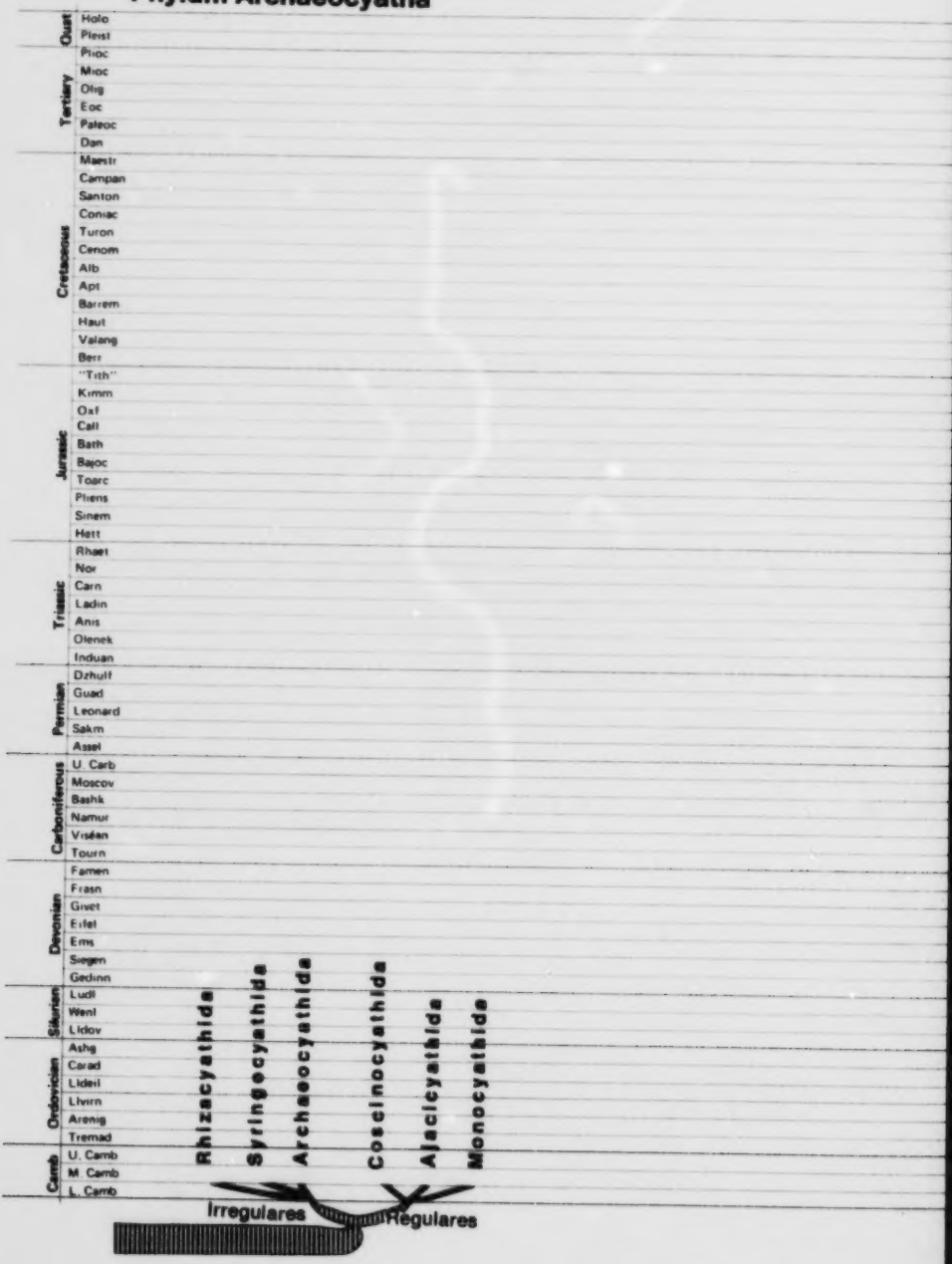


Chart 6/Tableau n° 6

Phylum Coelenterata	
Class Hydrozoa	
Order Trachylinida	JurBajoc—Rec
Order Hydroida	Camb M.Camb—Rec
Order Siphonophorida	Precambrian—Rec
Order Spongiomorphida	TriasOlenek—JurTith
Order Milleporina	TertDan—Rec
Order Stylasterina	TertDan—Rec
Order Sphaeractinida	Carb U.Carb—CretCenom
Order Stromatoporoidea	Camb L.Camb—TertEoc
Class Scyphozoa	
Subclass Scyphomedusae	
Order Stauromedusida	Rec
Order Carybdeida	JurTith—Rec
Order Coronatida	Camb L.Camb—Rec
Order Semaeostomatida	JurTith—Rec
Order Lithorhizostomatida	JurTith
Order Rhizostomatida	JurTith—Rec
Order Conchopeltida	OrdCarad
Class Anthozoa	
Subclass Ceriantipatharia	
Order Antipatharia	TertMioc—Rec
Order Ceriantharia	Rec
Subclass Octocorallia	
Order Stolonifera	Cret ?Berr—Rec
Order Telestacea	Rec
Order Alcyonacea	Jur ?Hett—Rec
Order Trachypsammiacea	PermGuad
Order Coenothecalia	Cret ?Berr—Rec
Order Gorgonacea	Cret ?Berr—Rec
Order Pennatulacea	Cret ?Berr—Rec
Subclass Zoantharia	
Infraclass Tabulata	
Order Favositida	OrdLldeil—PermDzhulf
Order Syringoporida	OrdCarad—PermDzhulf
Order Sarcinulida	OrdCarad—SilWenl
Order Auloporida	OrdAshg—PermDzhulf
Order Lichenariida	OrdArenig—SilLldov
Order Tetradiida	OrdLldeil—OrdAshg
Order Halysitida	OrdCarad—DevEms
Infraclass Heliolitoidea	
Order Protaraeida	OrdLldeil—SilLudl
Order Heliolitida	OrdLldeil—DevFrasn
Order Proporida	OrdCarad—SilLudl
Infraclass Rugosa	
Order Streptelasmatida	OrdCarad—PermDzhulf
Order Columnariida	OrdCarad—PermLeonard
Order Cystiphyllida	OrdCarad—DevGivet
Infraclass Heterocorallia	CarbViséan
Infraclass Scleractinia	
Order Astrocoeniida	TriasLadin—Rec
Order Fungiida	TriasAnis—Rec
Order Faviida	TriasAnis—Rec
Order Caryophyllida	JurHett—Rec
Order Dendrophylliida	CretCenom—Rec

Infraclass Corallimorpharia	Rec
Infraclass Zoanthinaria	Rec
Infraclass Actinaria	Rec

Dipleurozoa and Protomedusae were proved not to be coelenterates. Conulariida are referred to Phylum *incertae sedis*.

On a démontré que les dipleurozoaires et les protoméduses ne sont pas des coelentérés. Quant aux conularides, on n'a pas encore réussi à les classer de façon certaine.

Phylum Coelenterata

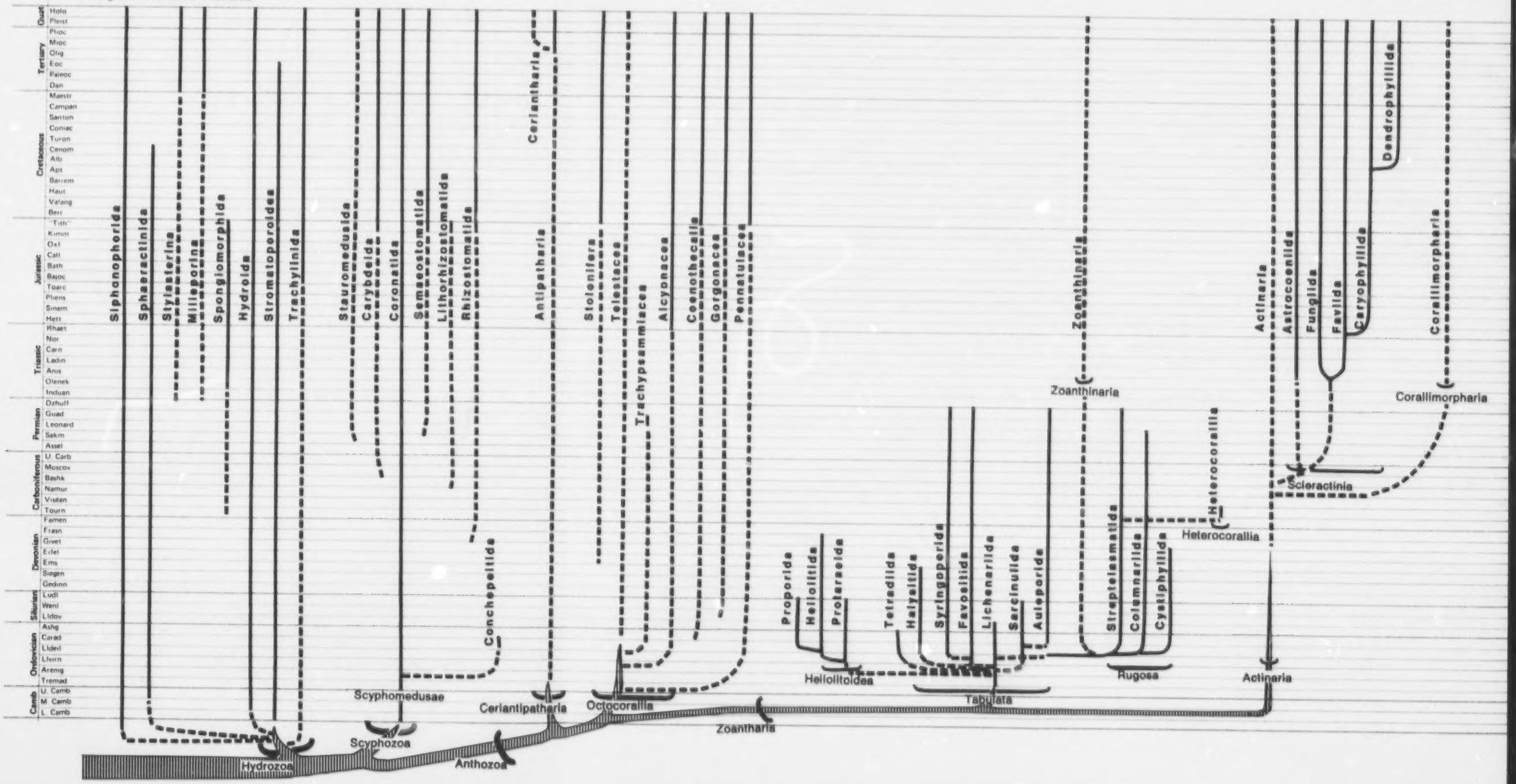


Chart 7 Phylum Mollusca Stem Graph
Tableau n° 7 Phylum Mollusca Ramifications principales

Chart 7/Tableau n° 7

Phylum Mollusca	Stem Graph Ramifications principales
Class Stenothecoida	
Order Cambridioidea	Camb L.Camb
Class Mattheva	
Order Matthevoida	Camb U.Camb
Class Monoplacophora	
Order Tryblidioidea	Camb L.Camb-DevGivet—Rec
Order Archinacelloidea	Camb U.Camb—SilLldov
Class Placophora	
Order Palaeoloricata	Camb U.Camb—CretCampan
Order Neoloricata	OrdAshg—Rec
Class Caudofoveata	Rec
Class Solenogastres	Rec
Class Rostroconchia *(not included; related to and perhaps intermediate between Bivalvia and Scaphopoda/exclue; apparentée aux lamellibranches et aux scaphopodes et peut-être à mi-chemin entre ces deux classes)*	OrdLldeil—PermGuad
Class Ribeirioda *(not included; represents the transitional group between an unknown univalve and the Rostroconchia, Bivalvia, and Scaphopoda/exclue; représente le stade de transition entre un univalve inconnu et les classes des rostroconques, des lamellibranches et des scaphopodes)*	Camb U.Camb—OrdAshg

Phylum Mollusca stem graph

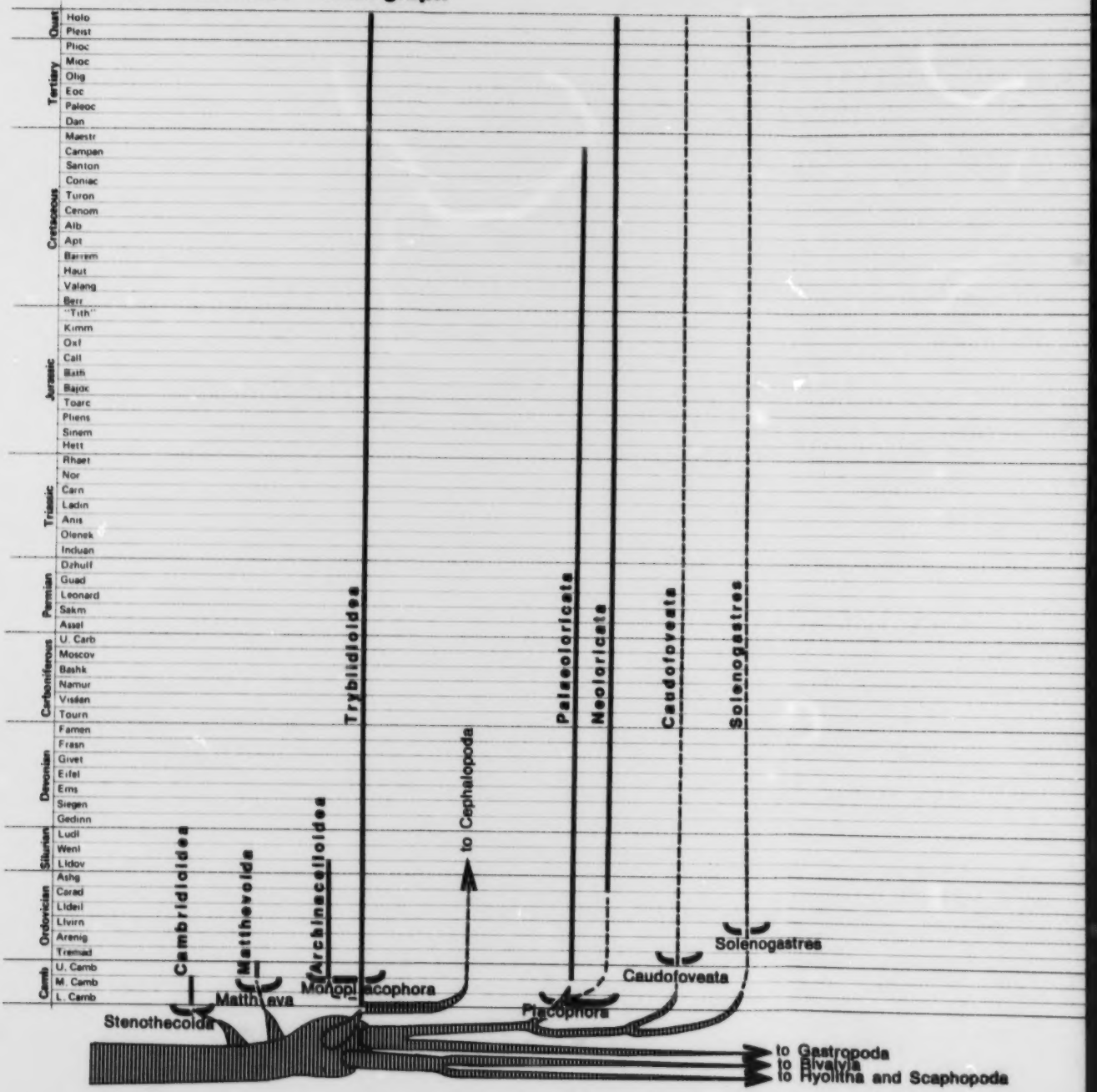


Chart 8/Tableau n° 8
Phylum Mollusca Class Hyolitha Class Scaphopoda

Chart 8/Tableau n° 8

Phylum Mollusca Class Hyolitha Class Scaphopoda

Class Hyolitha Order Hyolithida	Camb L.Camb—PermGuad
Class Scaphopoda	DevSiegen—Rec

Phylum Mollusca Class Hyolitha Class Scaphopoda

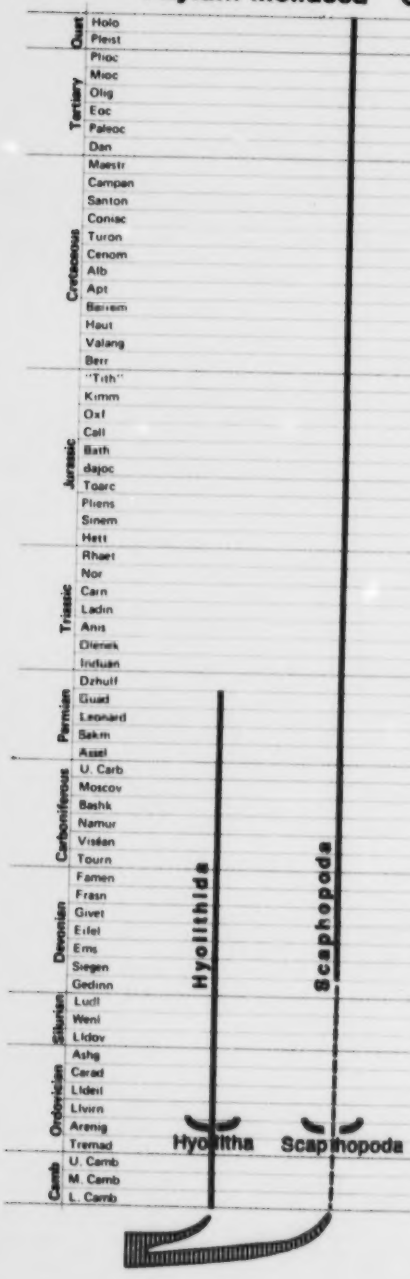


Chart 9/Tableau n° 9 Phylum Mollusca Class Bivalvia

Chart 9/Tableau n° 9

Phylum Mollusca Class Bivalvia

Subclass Palaeotaxodonta	
Order Solemyoida	DevSiegen—Rec
Order Nuculoida	OrdArenig—Rec
Subclass Isofilibranchia	
Order Mytiloida	OrdArenig—Rec
Subclass Pteriomorphia	
Order Arcoida	OrdLldeil—Rec
Order Pterioida	OrdCarad—Rec
Subclass Heteroconchia	
Order Actinodontoida	OrdTremad—OrdAshg—?Rec
Order Unionoida	DevFrasn—Rec
Order Trigonioida	OrdArenig—Rec
Order Veneroida	OrdCarad—Rec
Order Myoida	CarbTourn—Rec
Order Hippuritoida	SilWenl—CretMaestr
Subclass Anomalodesmata	
Order Pholadomyoida	OrdCarad—Rec

Order Praecardioida is not included.
L'ordre des praecardioida est exclu.

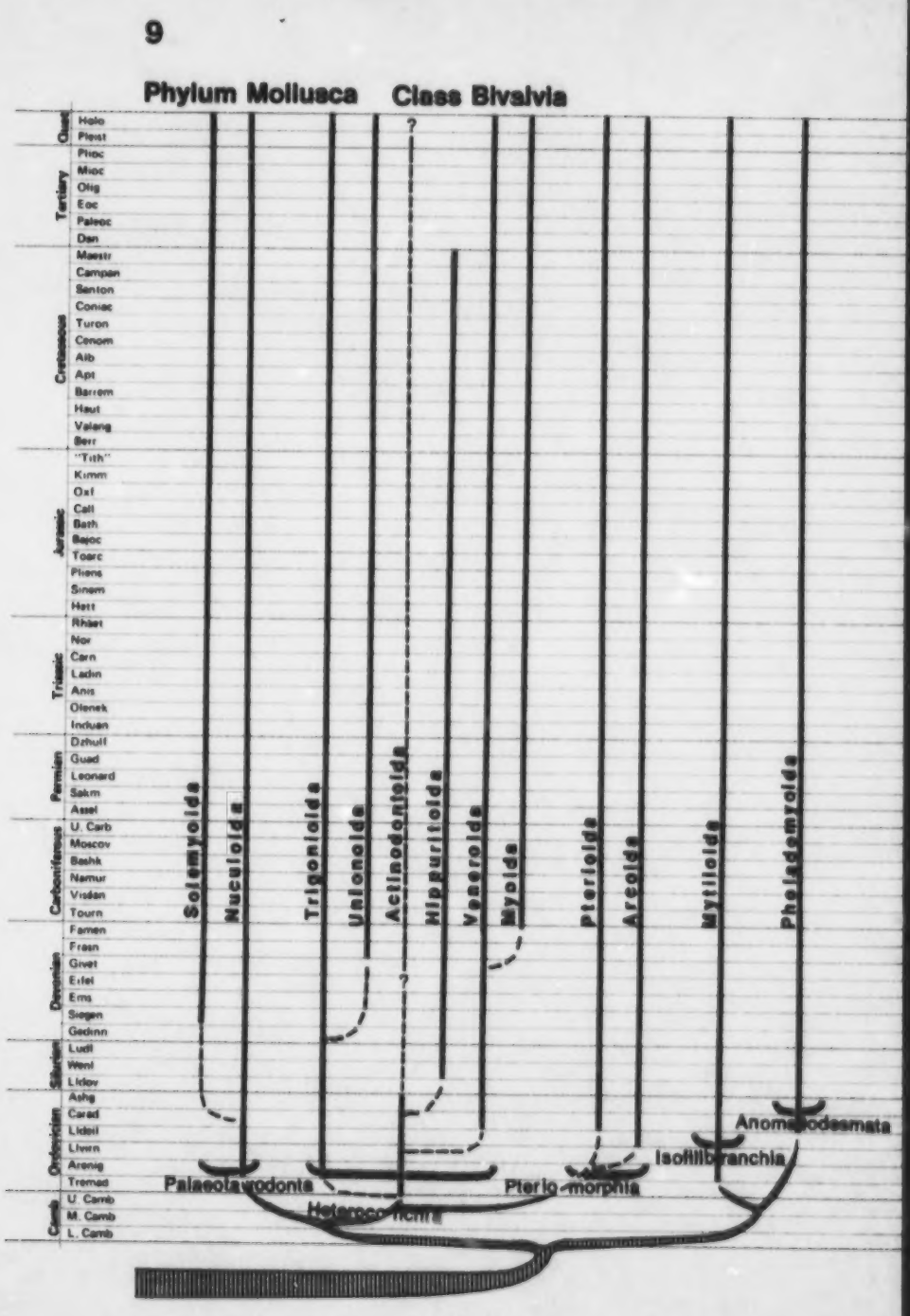

Phylum Mollusca
Class Bivalvia
Quat
Holo
Pleist
Tertiary
Plioc
Mioc
Olig
Eoc
Paleoc
Dan
Cretaceous
Maestr
Campan
Santon
Coniac
Turon
Cenom
Alb
Apt
Barrem
Haut
Valang
Berr
Jurassic
"Tith"
Kimm
Oxf
Call
Bath
Bajoc
Toarc
Pliens
Sinem
Hett
Triassic
Rhaet
Nor
Carn
Ladin
Anis
Olenek
Induan
Permian
Dzhulf
Guad
Leonard
Sakm
Assel
Carboniferous
U. Carb
Moscov
Bashk
Namur
Visén
Tourn
Devonian
Famen
Fras
Givet
Eifel
Ems
Siegen
Gedinn
Silurian
Ludl
Wenl
Lldov
Ordovician
Ashg
Carad
Lldeil
Llvirn
Arenig
Tremad
Camb
U. Camb
M. Camb
L. Camb
Solemyoida
Nuculoida
Trigonioida
Unionoida
Actinodontoida
Hippuritoida
Verenoida
Myoida
Pterioida
Arcoida
Mytiloida
Pholadomyoida
?
?
Anomalodesmata
Isofilibranchia
Pterio-morphia
Palaeotaxodonta
Heterodonta

Chart 10/Tableau n° 10 Phylum Mollusca Class Gastropoda

Chart 10/Tableau n° 10

Phylum Mollusca Class Gastropoda

Subclass Prosobranchia	
Order Archaeogastropoda	Camb U.Camb—Rec
Order Mesogastropoda	OrdCarad—Rec
Order Neogastropoda	JurKimm—Rec
Subclass Opisthobranchia	
Order Cephalaspidea	CarbViséan—Rec
Order Pyramidellacea	DevGedinn—Rec
Order Philinoglossacea	Rec
Order Anaspidea	Rec
Order Notaspidea	Rec
Order Sacoglossa	Rec
Order Thecosomata	TertEoc—Rec
Order Gymnosomata	Rec
Order Nudibranchia	Rec
Order Rhodopacea	Rec
Order Onchidiacea	Rec
Subclass Pulmonata	
Order Basommatophora	Carb U.Carb—Rec
Order Stylommatophora	CretTuron—Rec

Order Systellomatophora is not included.
L'ordre des systellomatophora est exclu.

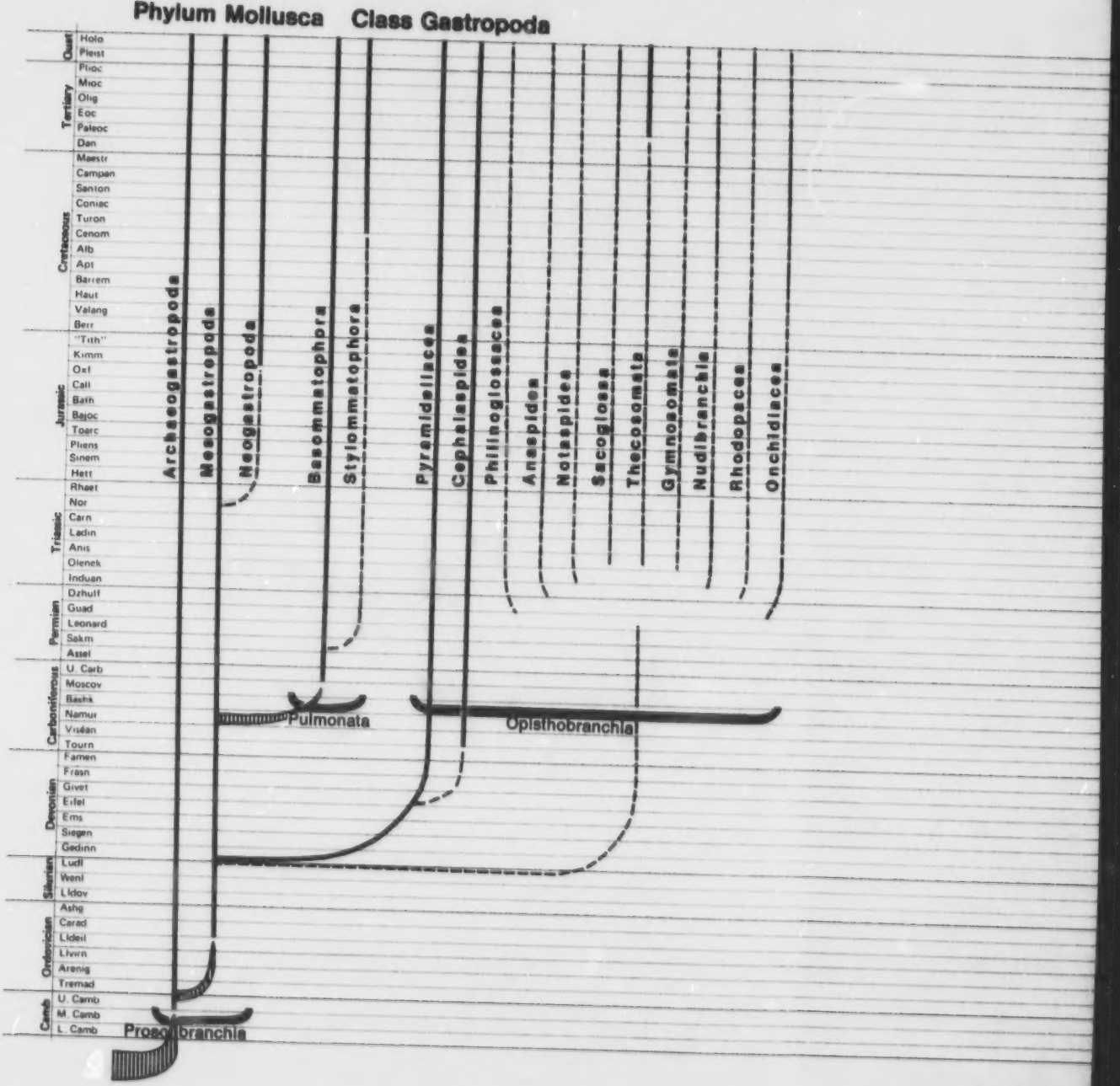

Phylum Mollusca Class Gastropoda
Quat
Holo
Pleist
Tertiary
Plioc
Mioc
Olig
Eoc
Paleoc
Dan
Cretaceous
Maestr
Campan
Santon
Coniac
Turon
Cenom
Alb
Apt
Barrem
Haut
Valang
Berr
Jurassic
"Tith"
Kimm
Oxf
Call
Bath
Bajoc
Toarc
Pliens
Sinem
Hett
Triassic
Rhaet
Nor
Carn
Ladin
Anis
Olenek
Induan
Permian
Dzhulf
Guad
Leonard
Sakm
Assel
Carboniferous
U. Carb
Moscov
Bashk
Namur
Viséan
Tourn
Devonian
Famen
Frasn
Givet
Eifel
Ems
Siegen
Gedinn
Silurian
Ludl
Wenl
Lldov
Ordovician
Ashg
Carad
Lldeil
Llvrn
Areng
Tremad
Camb
U. Camb
M. Camb
L. Camb
Archaeogastropoda
Mesogastropoda
Neogastropoda
Basommatophora
Stylommatophora
Pyramidellacea
Cephalaspidea
Phillinoglossacea
Anaspidea
Notaspidea
Sacoglossa
Thecosomata
Gymnosomata
Nudibranchia
Rhodopacea
Onchidiacea
Pulmonata
Opisthobranchia
Prosobranchia

Chart 11/Tableau n° 11
Phylum Mollusca Class Cephalopoda

Chart 11/Tableau n° 11

Phylum Mollusca Class Cephalopoda

Subclass Ectocochlia	
Superorder Nautiloidea	
Order Ellesmerocerida	Camb U.Camb—OrdAshg
Order Orthocerida	OrdArenig—TriasNor
Order Ascocerida	OrdLldeil—SilLudl
Order Actinocerida	OrdLlvirn—CarbNamur
Order Endocerida	OrdArenig—SilWenl
Order Discosorida	OrdLlvirn—DevGivet
Order Oncocerida	OrdLlvirn—CarbNamur
Order Nautilida	DevSiegen—Rec
Order Tarphycerida	OrdArenig—DevGivet
Superorder Ammonoidea	
Order Bactritida	OrdArenig—TriasCarn
Order Anarcestida	DevSiegen—DevFamen
Order Clymeniida	DevFamen
Order Goniatitida	DevEifel—TriasInduan
Order Ceratitida	PermLeonard—TriasRhaet
Order Prolecanitida	DevFamen—TriasOlenek
Order Phyllocerida	TriasOlenek—CretMaestr
Order Lytocerida	JurHett—CretMaestr
Order Ammonitida	JurHett—CretMaestr
Subclass Coleoidea	
Order Belemnitida	CarbNamur—TertEoc
Order Octopida	CretConiac—Rec
Order Sepiida	CretCenom—Rec
Order Teuthida	PermLeonard—Rec
Order Phragmoteuthida	PermGuad—JurSinem
Order Aulacocerida	DevFrasn—JurOxf

Phylum Mollusca **Class Cephalopoda**

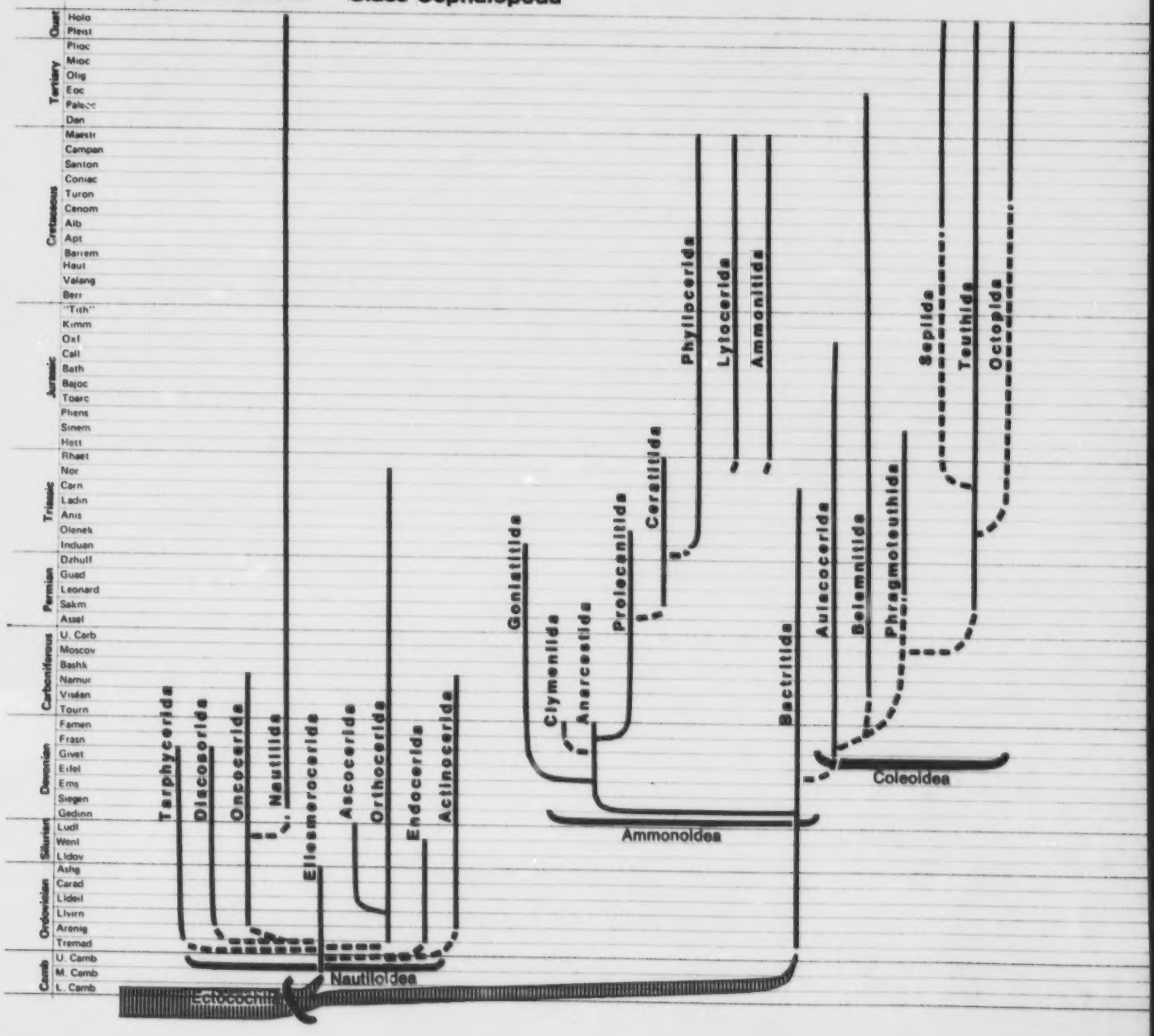


Chart 12/Tableau n° 12 Phylum Annelida

Chart 12/Tableau n° 12

Phylum Annelida	
Class Polychaeta	
Subclass Errantia	OrdTremad—Rec
Subclass Sedentaria	Camb M.Camb—Rec
Subclass Miskoiida	Camb M.Camb—OrdAshg
?Class Archiannelida	Rec
Class Oligochaeta	
Order Plesiopora	CarbBashk—Rec
Order Prosopora	TertOlig—Rec
Order Opisthopora	TertOlig—Rec
?Class Oligochaeta	
Aelosomatidae	Rec
Brachiobdellidae	Rec
Class Hirudinea	
Order Acanthobdellida	JurBajoc—Rec
Order Rhynchobdellida	Rec
Order Gnathobdellida	Rec
Order Pharyngobdellida	Rec

Phylum Annelida

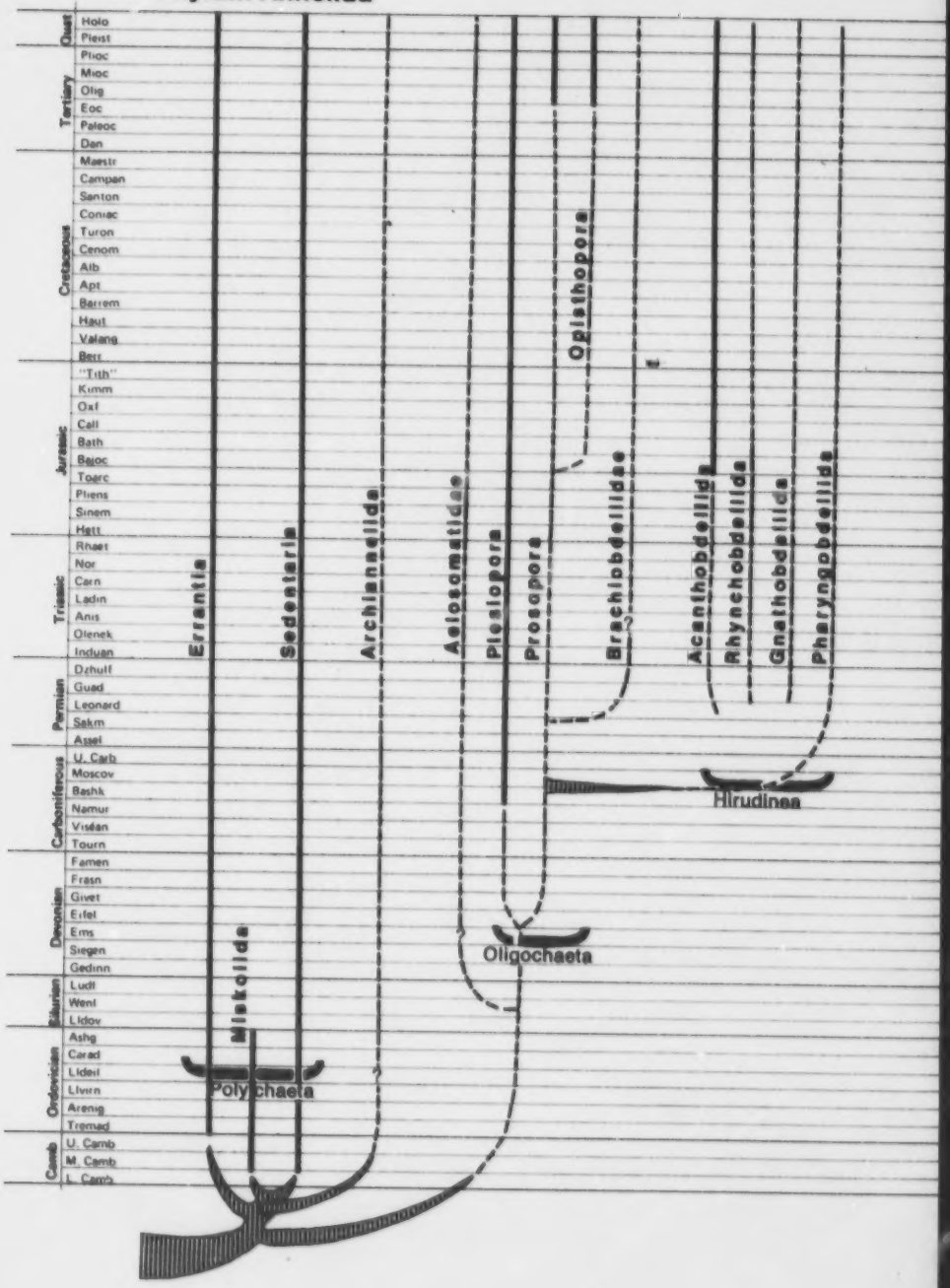


Chart 13/Tableau n° 13 Phylum Onychophora

Chart 13/Tableau n° 13

Phylum Onychophora

Order Protonychophora	Camb M.Camb
Order Euonychophora	Rec
?Order Xenusion	?Precambrian

Phylum Onychophora

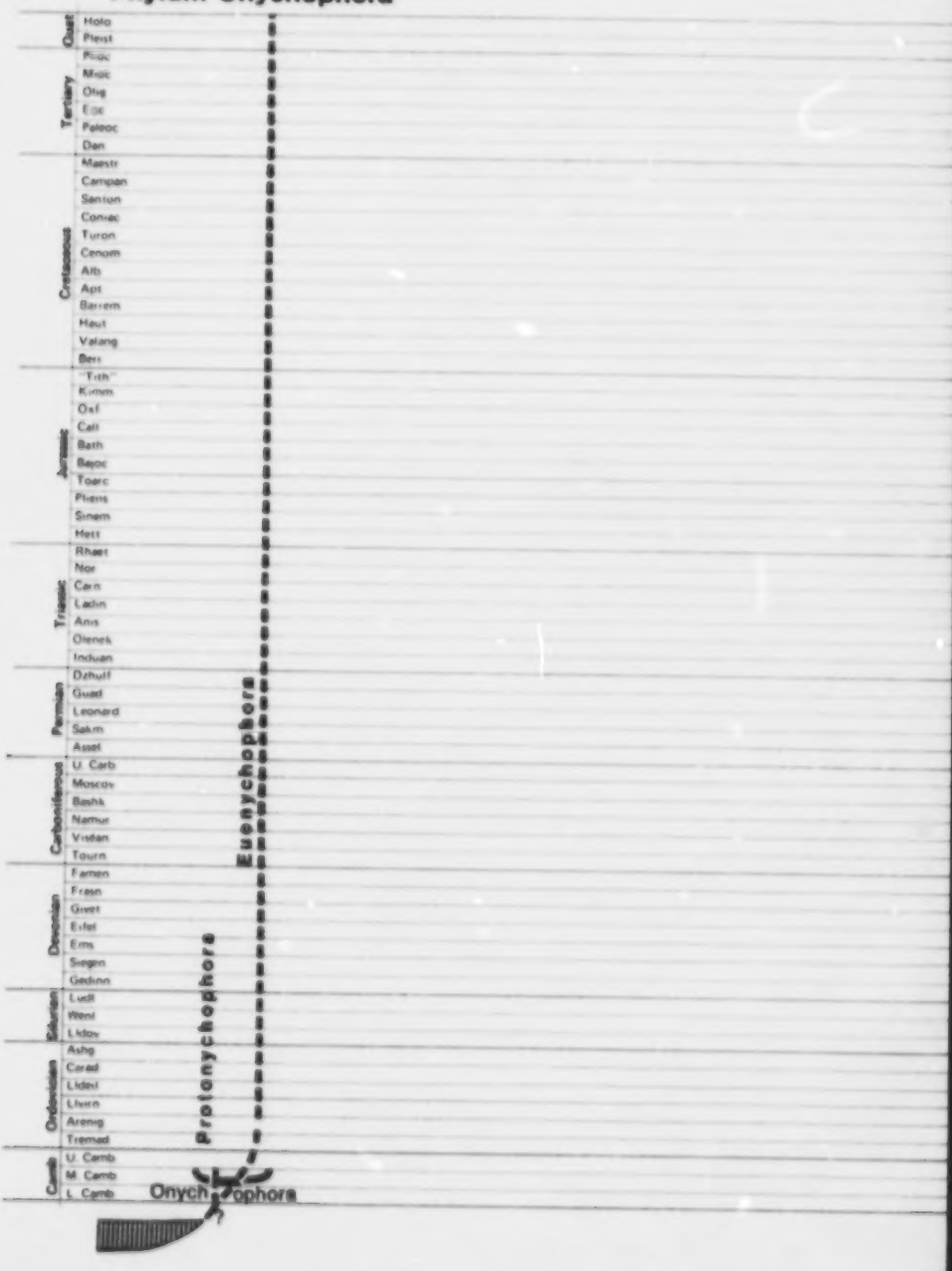


Chart 14 Phylum Arthropoda
Subphylum Trilobitomorpha Stem Graph
Tableau n° 14 Phylum Arthropoda
Subphylum Trilobitomorpha Ramifications principales

Chart 14/Tableau n° 14

Phylum Arthropoda Subphylum Trilobitomorpha Stem Graph
Ramifications principales

Class Trilobitoidea
Subclass Marrellomorpha
Order Marrellida — Camb M.Camb

Subclass Merostomoidea
Order Limulavida — Camb L.Camb—Camb M.Camb
Order Emeraldellida — Camb M.Camb
Order Nectaspida — Camb M.Camb
Order Leanchoiliida — Camb M.Camb

Subclass Pseudonotostraca (Pseudocrustacea)
Order Burgessiida — Camb M.Camb
Order Waptiida — Camb M.Camb

?Subclass
Order Opabiniida — Camb M.Camb
Order Cheloniellida — DevSiegen

?Subclass
?Order Yohoia, Helmetia, Mollisonia, Houghtonites, etc. — Camb M.Camb

Class Trilobita
(see next graph / voir le tableau suivant)

S. M. Manton (*in* The evolution of arthropodan locomotory mechanisms, *Zool. J. Linnean Soc.* 51: 203-400) has proposed grouping Onychophora, Myriapoda and Hexapoda into a separate phylum, Uniramia.

S.M. Manton (dans The evolution of arthropodan locomotory mechanisms, *Zool. J. Linnean Soc.* 51: 203-400) propose de grouper les onychophores, myriapodes et hexapodes dans un embranchement particulier, celui des uniramia.

Phylum Arthropoda Subphylum Trilobitomorpha

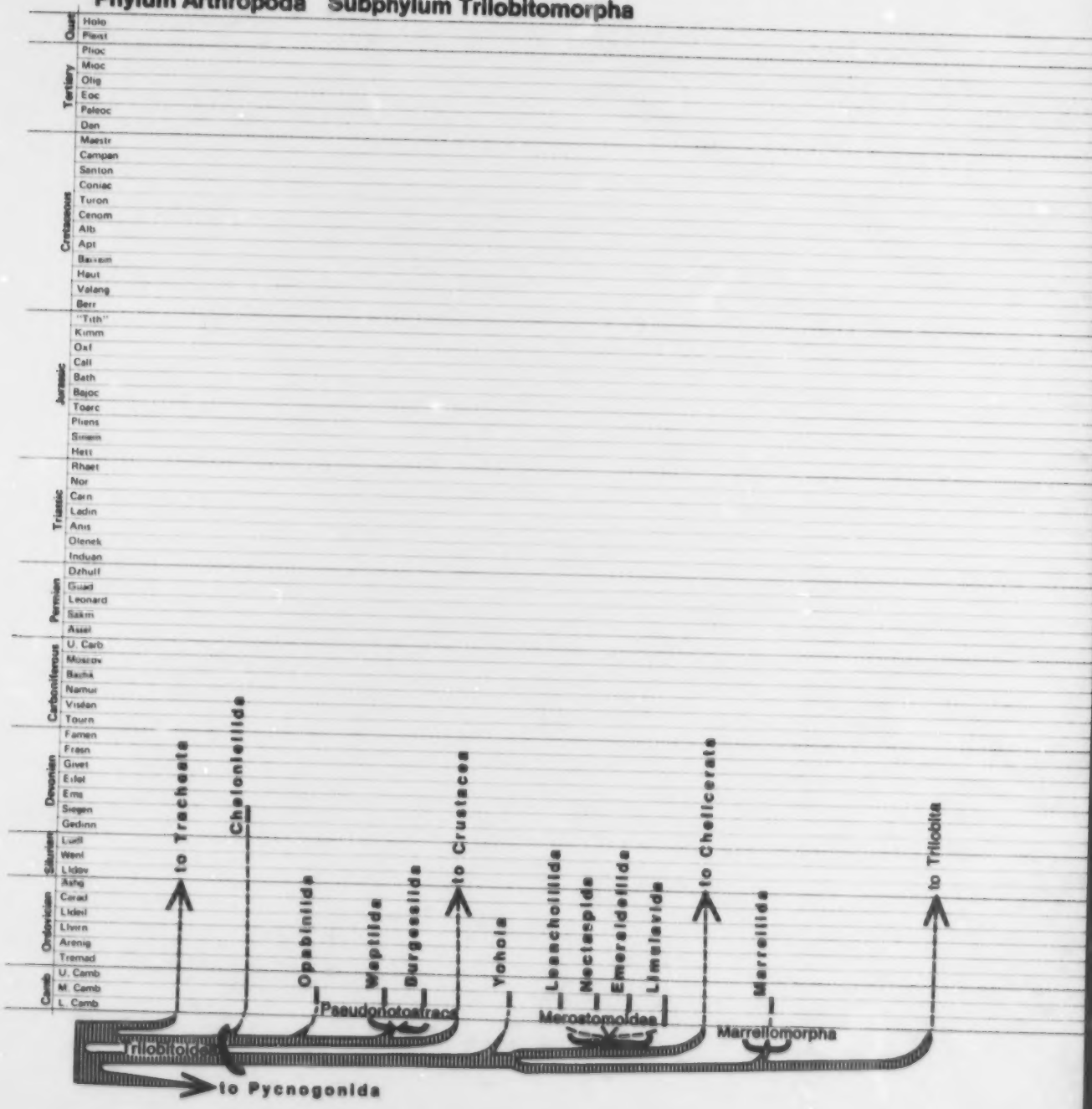


Chart 15/Tableau n° 15
Phylum Arthropoda Subphylum Trilobitomorpha

Chart 15/Tableau n° 15

Phylum Arthropoda Subphylum Trilobitomorpha

Class Trilobita	
Order Agnostida	
Suborder Agnostina	Camb L.Camb—OrdAshg
Suborder Eodiscina	Camb L.Camb—Camb M.Camb
Order Redlichiida	
Suborder Olenellina	Camb L.Camb
Suborder Redlichiina	Camb L.Camb—Camb M.Camb
Suborder Bathynotina	Camb L.Camb—Camb M.Camb
Order Corynexochida	Camb L.Camb—Camb U.Camb
Order Ptychopariida	
Suborder Ptychopariina	Camb L.Camb—OrdAshg
Suborder Asaphina	Camb M.Camb—OrdAshg
Suborder Illaenina	Camb U.Camb—PermDzhulf
Suborder Harpina	Camb U.Camb—DevFrasn
Suborder Trinucleina	OrdTremad—SilLudl
Order Phacopina	
Suborder Cheirurina	Camb U.Camb—DevEifel
Suborder Calymenina	OrdTremad—DevGivet
Suborder Phacopina	OrdArenig—DevFamen
Order Lichida	OrdTremad—DevFamen
Order Odontopleurida	Camb M.Camb—DevFrasn

Phylum Arthropoda Subphylum Trilobitomorpha Class Trilobita

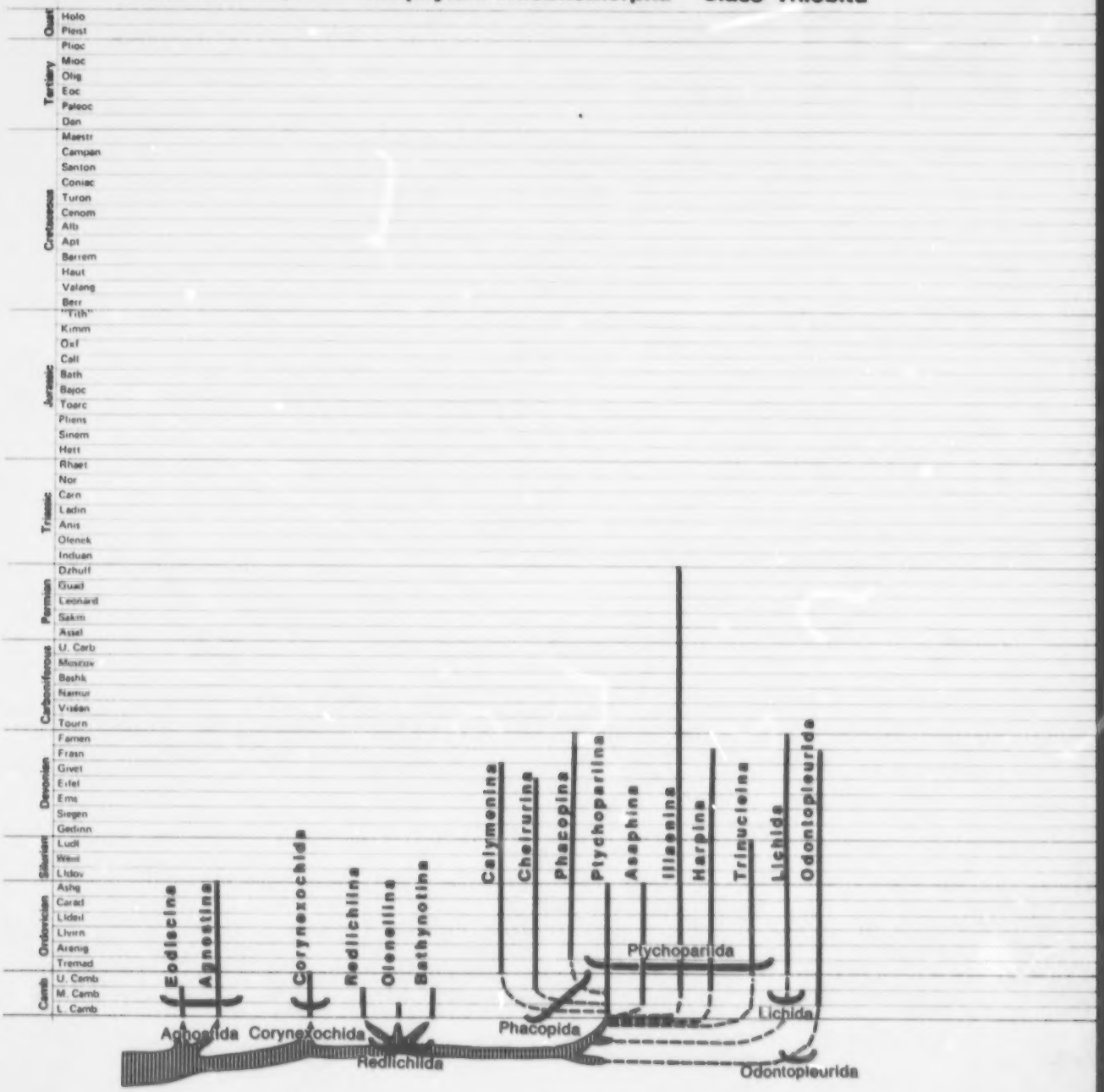


Chart 16/Tableau n° 16
Phylum Arthropoda Subphylum Chelicerata

Chart 16/Tableau n° 16

Phylum Arthropoda Subphylum Chelicerata

Class Merostomata	
Subclass Xiphosura	
Order Aglaspida	Camb L.Camb—OrdCarad
Order Chasmataspidida	OrdLlvirn
Order Synziphosura	SilWenl—DevSiegen
Order Limulida	DevGedinn—Rec
Subclass Euryptera	
Order Eurypterida	OrdArenig—PermLeonard
Class Arachnida	
Order Scorpiones	SilWenl—Rec
Order Pseudoscorpiones	TertEoc—Rec
Order Opiliones	CarbMoscov—Rec
Order Architarbi	CarbBashk—CarbMoscov
Order Acari	DevEms—Rec
Order Haptopoda	CarbBashk
Order Anthracomarti	CarbBashk—Carb U.Carb
Order Trigonotarbi	DevEms—Carb U.Carb
Order Palpigradi	JurTith—Rec
Order Uropygi	CarbBashk—Rec
Order Kustarachnida	CarbMoscov
Order Amblypygi	CarbBashk—Rec
Order Araneae	DevEms—Rec
Order Solifugae	CarbMoscov—Rec
Order Ricinulei	CarbBashk—Rec
Order Schizomida	TertPlioc—Rec

Phylum Arthropoda Subphylum Chelicerata

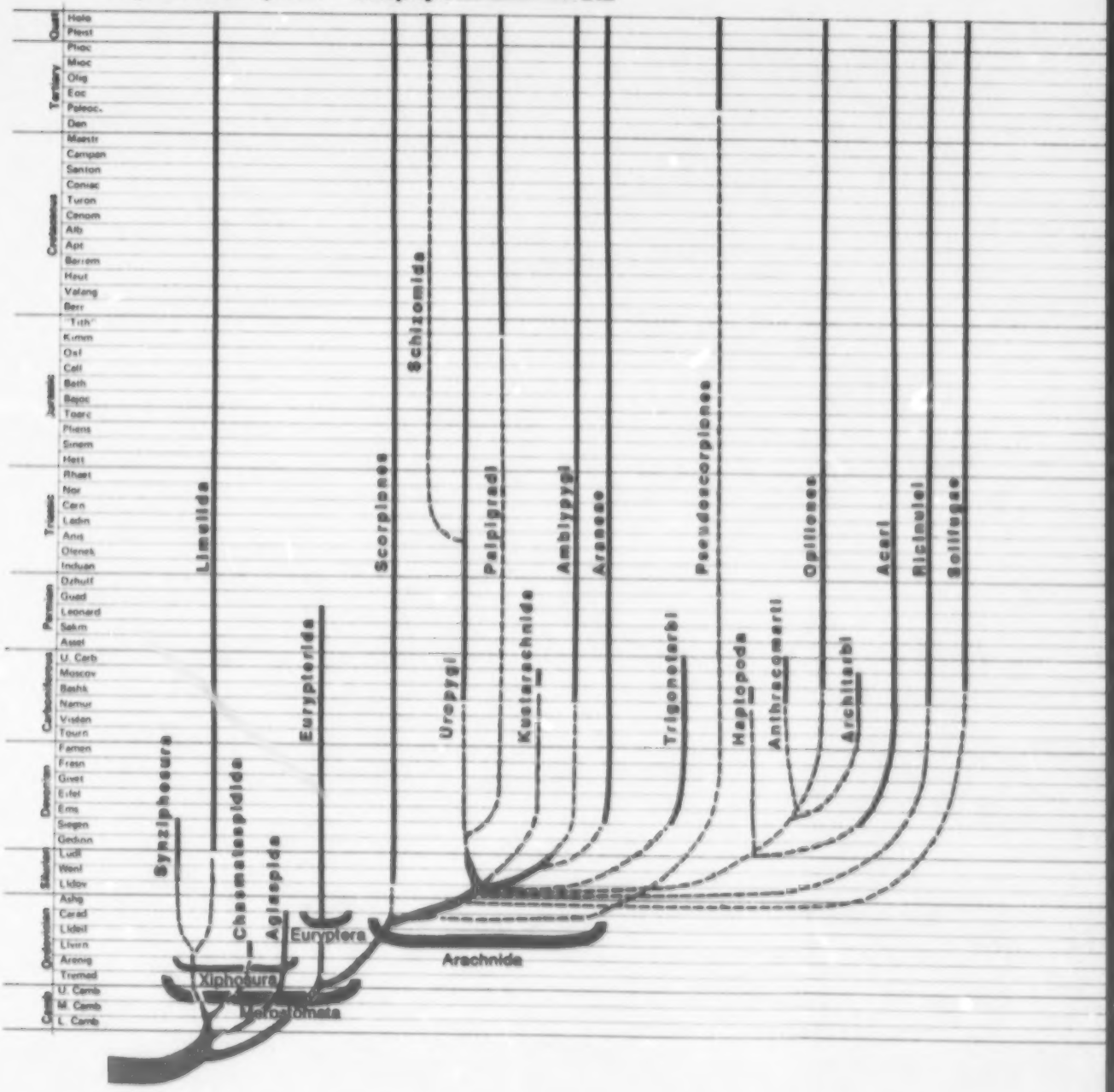


Chart 17/Tableau n° 17
Phylum Arthropoda Subphylum Pycnogonida

Chart 17/Tableau n° 17

Phylum Arthropoda Subphylum Pycnogonida

Order Pantopoda	Rec
Order Palaeopantopoda	DevSiegen

Phylum Arthropoda Subphylum Pycnogonida

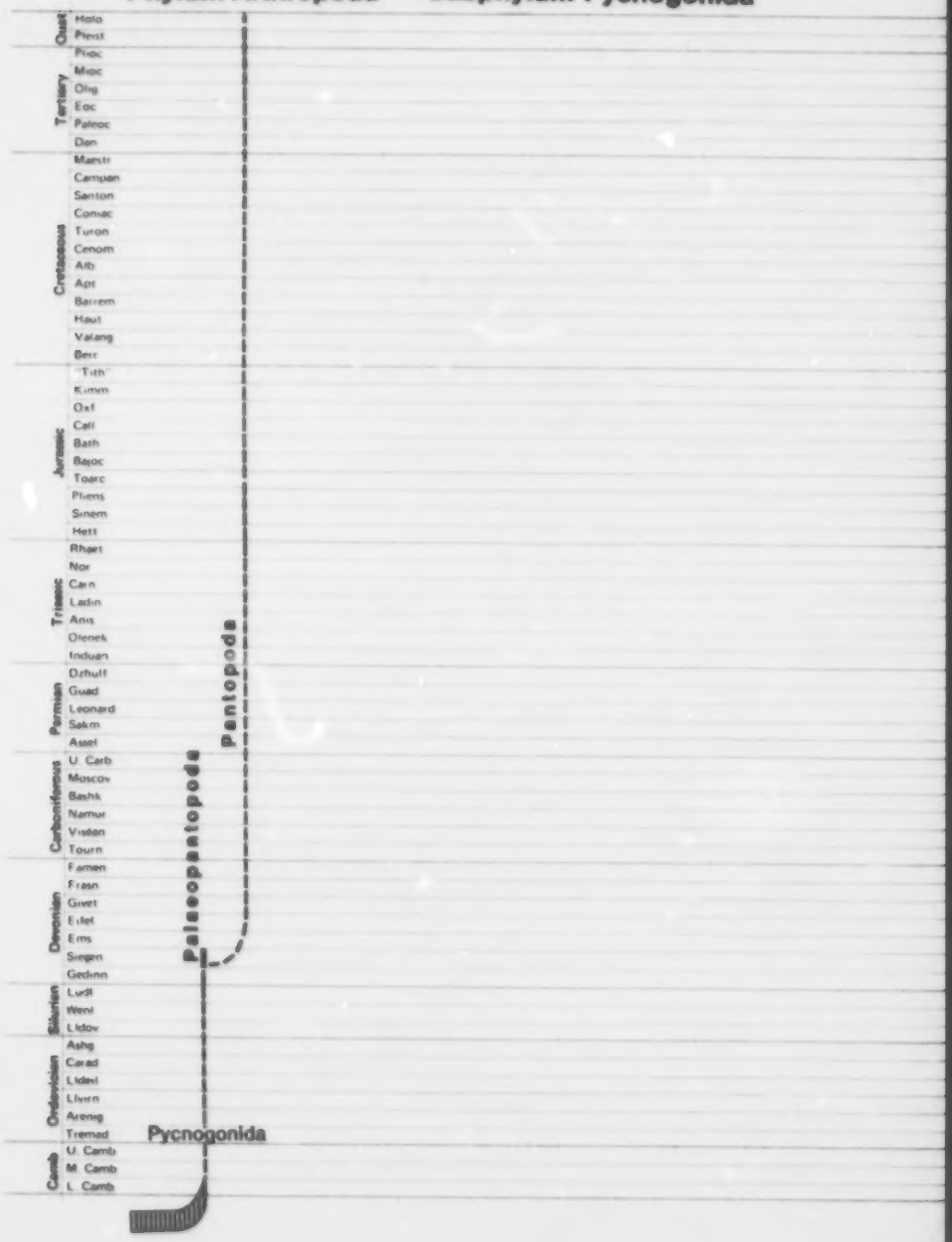


Chart 18/Tableau n° 18

Phylum Arthropoda Subphylum Crustacea

Class Cephalocarida	
Order Brachypoda	Rec
Class Branchiopoda	
Subclass Sarsostraca	
Order Anostraca	DevSiegen—Rec
Order Lipostraca	DevSiegen—DevEifel
Subclass Calmanostraca	
Order Notostraca	CarbNamur—Rec
Order Kazacharthra	JurHett—JurToarc
Order Acercostraca	DevSiegen
Subclass Diplostraca	
Order Conchostraca	DevGedinn—Rec
Order Cladocera	CretCenom—Rec
Class Ostracoda	
Order Archaeocopida	Camb L.Camb—OrdTremad
Order Leperditicopida	OrdTremad—DevFamen
Order Palaeocopida	OrdArenig—PermGuad—?Rec
Order Myodocopida	OrdLlvirn—Rec
Order Podocopida	OrdLldeil—Rec
Class Euthycarcinoidea	
Order Euthycarcinida	TriasOlenek—Trias ?Ladin
Class Mystacocarida	Rec
Class Copepoda	
Order Calanoida	Rec
Order Harpacticoida	TertMioc—Rec
Order Cyclopoida	TertMioc—Rec
Order Notodelphyoida	Rec
Order Caligoida	Rec
Order Lernaeopodoida	Rec
Order Monstrilloida	Rec
Class Cirripedia	
Order Thoracica	SilLudl—Rec
Order Acrothoracica	Carb U.Carb—Rec
Order Ascothoracica	CretTuron—Rec
Order Rhizocephala	Rec
Class Branchiura	
Order Arguloida	Rec
Class Malacostraca	
Subclass Phyllocarida	
Order Archaeostraca	OrdTremad—TriasCarn
Order Leptostraca	PermGuad—Rec.
Order Hymenostraca	Camb ?L.Camb—Camb M.Camb—OrdArenig

Subclass Eumalacostraca	
Superorder Hoplocarida	
Order Palaeostomatopoda	DevEifel—CarbNamur
Order Stomatopoda	JurTith—Rec
Superorder Eocarida	
Order Eocaridacea	DevGivet—CarbBashk
Order Pygocephalomorpha	CarbTourn—PermLeonard
Superorder Eucarida	
Order Euphausiacea	Rec
Order Decapoda	PermGuad—Rec
Superorder Peracarida	
Order Anthracocaridacea	CarbTourn—CarbBashk
Order Mysidacea	TriasOlenek—Rec
Order Cumacea	PermGuad—Rec
Order Tanaidacea	PermGuad—Rec
Order Isopoda	CarbBashk—Rec
Order Amphipoda	TertEoc—Rec
Order Spelaeogriphacea	Rec
Order Thermosbaenacea	Rec
Superorder Syncarida	
Order Anaspidacea	Trias ?Olenek—Rec
Order Stygocaridacea	Perm ?Assel—Rec
Order Bathynellacea	Rec
Order Palaeocaridacea	CarbViséan—Perm ?Dzhulf
?Class	
Order Bostrichopodida	Carb ?Tourn
(not included / exclu)	
?Class	
?Order Cycloidea	CarbTourn—TriasNor
(not included / exclu)	

Phylum Arthropoda Subphylum Crustacea

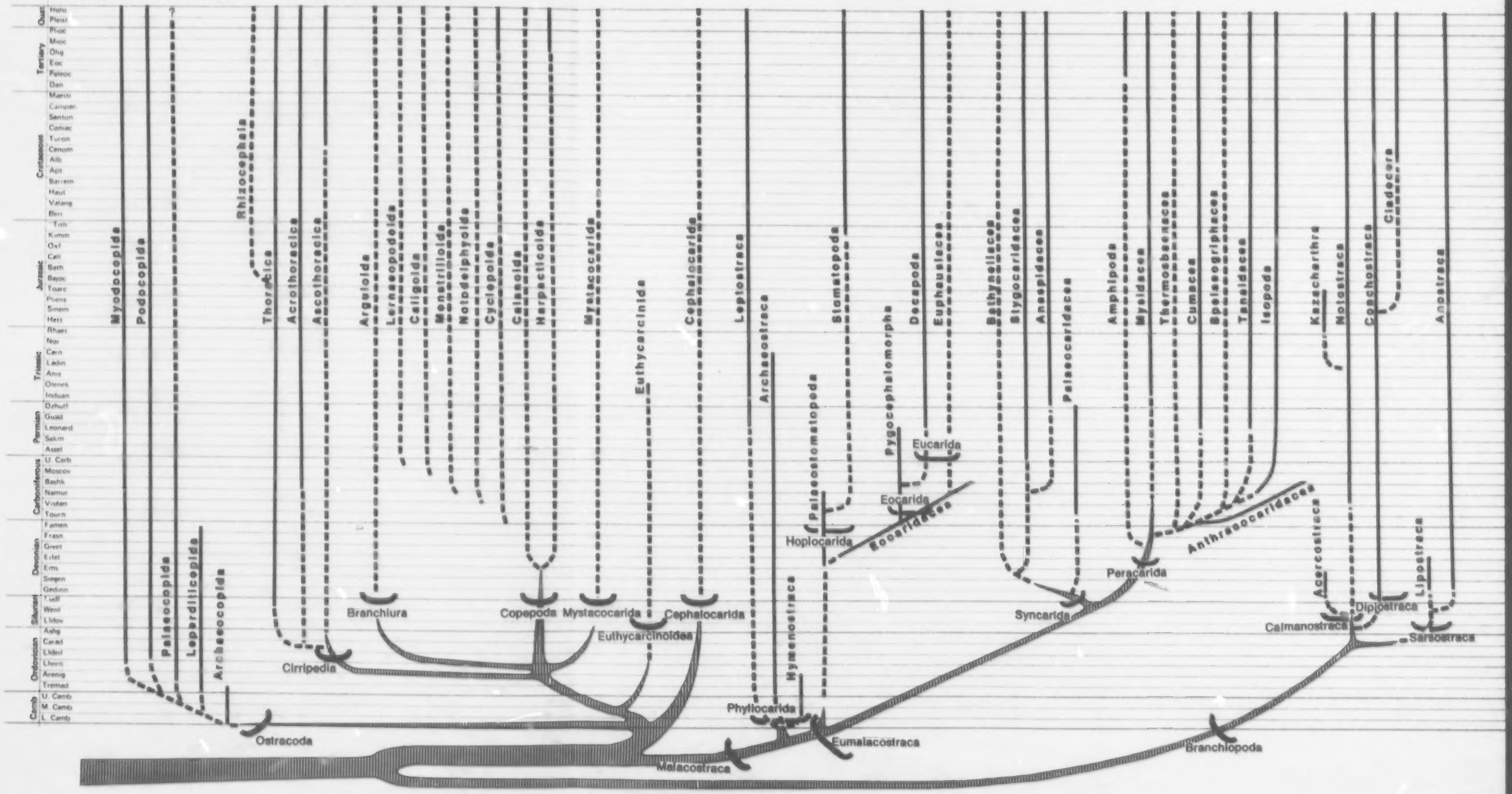


Chart 19/Tableau n° 19
Phylum Arthropoda Subphylum Tracheata

Chart 19/Tableau n° 19

Phylum Arthropoda Subphylum Tracheata

Class Pauropoda	
Order Hexamerocerata	Rec
Order Tetramerocerata	Rec
Class Arthropleurida	CarbBashk—Carb U.Carb
Class Archipolypoda	
Order Euphoberiida	SilLudl—Carb U.Carb
Class Diplopoda	
Subclass Penicellata	
Order Polyxenida	TertOlig—Rec
Subclass Pentazonia	
Order Glomerida	TertOlig—Rec
Order Sphaerotherida	Rec
Order Glomeridesmida	Rec
Order Amynilyspedida	CarbBashk—Carb U.Carb
Subclass Helminthomorpha	
Order Stemmiulida	Rec
Order Julida	TertOlig—Rec
Order Spirostreptida	CarbMoscov—Rec
Order Spirobolida	Carb U.Carb—Rec
Order Polyzoniida	TertOlig—Rec
Order Siphonophorida	Rec
Order Platydesmida	Rec
Order Chordeumida	TertOlig—Rec
Order Callipodida	TertOlig—Rec
Order Polydesmida	TertOlig—Rec
Class Chilopoda	
Subclass Epimorpha	
Order Geophilida	CretBerr—Rec
Order Scolopendrida	TertOlig—Rec
Subclass Anamorpha	
Order Lithobiida	TertOlig—Rec
Order Scutigerida	TertOlig—Rec
Class Symphyla	
Order Scolopendrellida	TertOlig—Rec
Class Protura	Rec
Class Collembola	DevEifel—Rec
Class Diplura	TertOlig—Rec
Class Insecta	

(see next graph/voir le tableau suivant)

Phylum Arthropoda Subphylum Tracheata

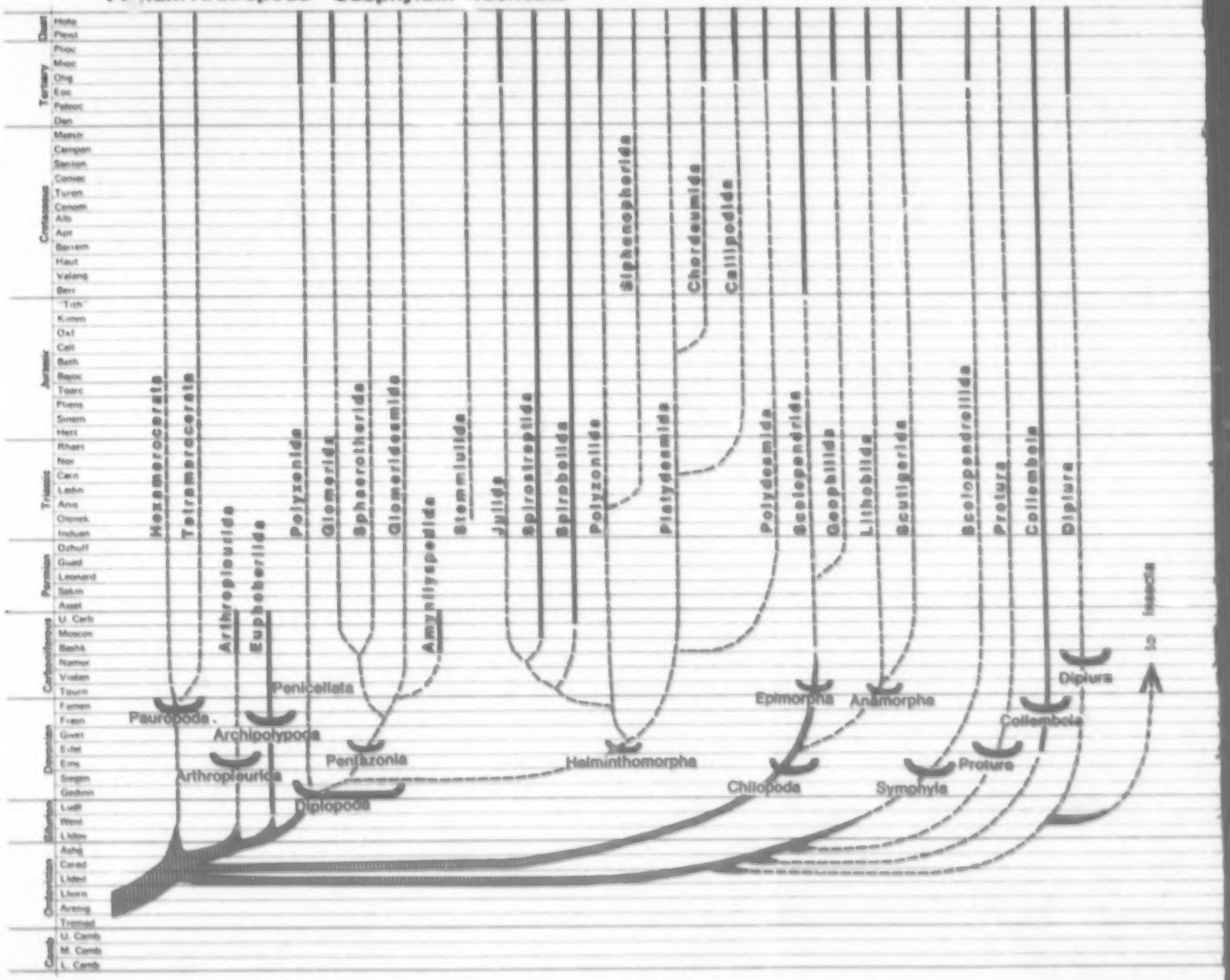


Chart 20/Tableau n° 20

Phylum Arthropoda Subphylum Tracheata Class Insecta

Subclass Apterygota	
Order Thysanura	Carb U.Carb—Rec
Subclass Pterygota	
Divisio Hemimetabola	
Palaeoptera	
Order Ephemeroptera	Carb U.Carb—Rec
Order Odonata	CarbBashk—Rec
Order Palaeodictyoptera	CarbBashk—PermGuad
Order Diaphanopterodea	CarbMoscov—PermGuad
Order Protodonata	CarbBashk—PermGuad
Neoptera	
Infraclass Polyneoptera	
Order Plecoptera	PermLeonard—Rec
Order Grylloblattodea	Rec
Order Orthoptera	CarbMoscov—Rec
Order Phasmida	Trias ?Ladin—Rec
Order Dermaptera	JurCall—Rec
Order Embioptera	TertOlig—Rec
Order Blattodea	CarbBashk—Rec
Order Mantodea	TertOlig—Rec
Order Isoptera	CretCenom—Rec
Order Protorthoptera	CarbNamur—PermDzhulf
Order Miomoptera	CarbNamur—PermGuad
Order Protelytroptera	PermLeonard—PermDzhulf
Order Caloneurodea	CarbMoscov—PermGuad
Infraclass Paraneoptera	
Order Zoraptera	Rec
Order Psocoptera	PermLeonard—Rec
Order Anoplura	QuatPleist—Rec
Order Mallophaga	Rec
Order Homoptera	PermLeonard—Rec
Order Heteroptera	PermDzhulf—Rec
Order Thysanoptera	PermLeonard—Rec
Divisio Holometabola	
Infraclass Oligoneoptera	
Order Glosselytrodea	PermLeonard—TriasRhaet
Order Neuroptera	PermLeonard—Rec
Order Megaloptera	PermLeonard—Rec
Order Raphidioptera	PermLeonard—Rec
Order Mecoptera	PermLeonard—Rec
Order Lepidoptera	CretCampan—Rec
Order Trichoptera	PermLeonard—Rec
Order Diptera	TriasRhaet—Rec
Order Siphonaptera	TertOlig—Rec
Order Hymenoptera	Trias ?Olenek—Rec
Order Coleoptera	PermLeonard—Rec
Order Strepsiptera	TertOlig—Rec

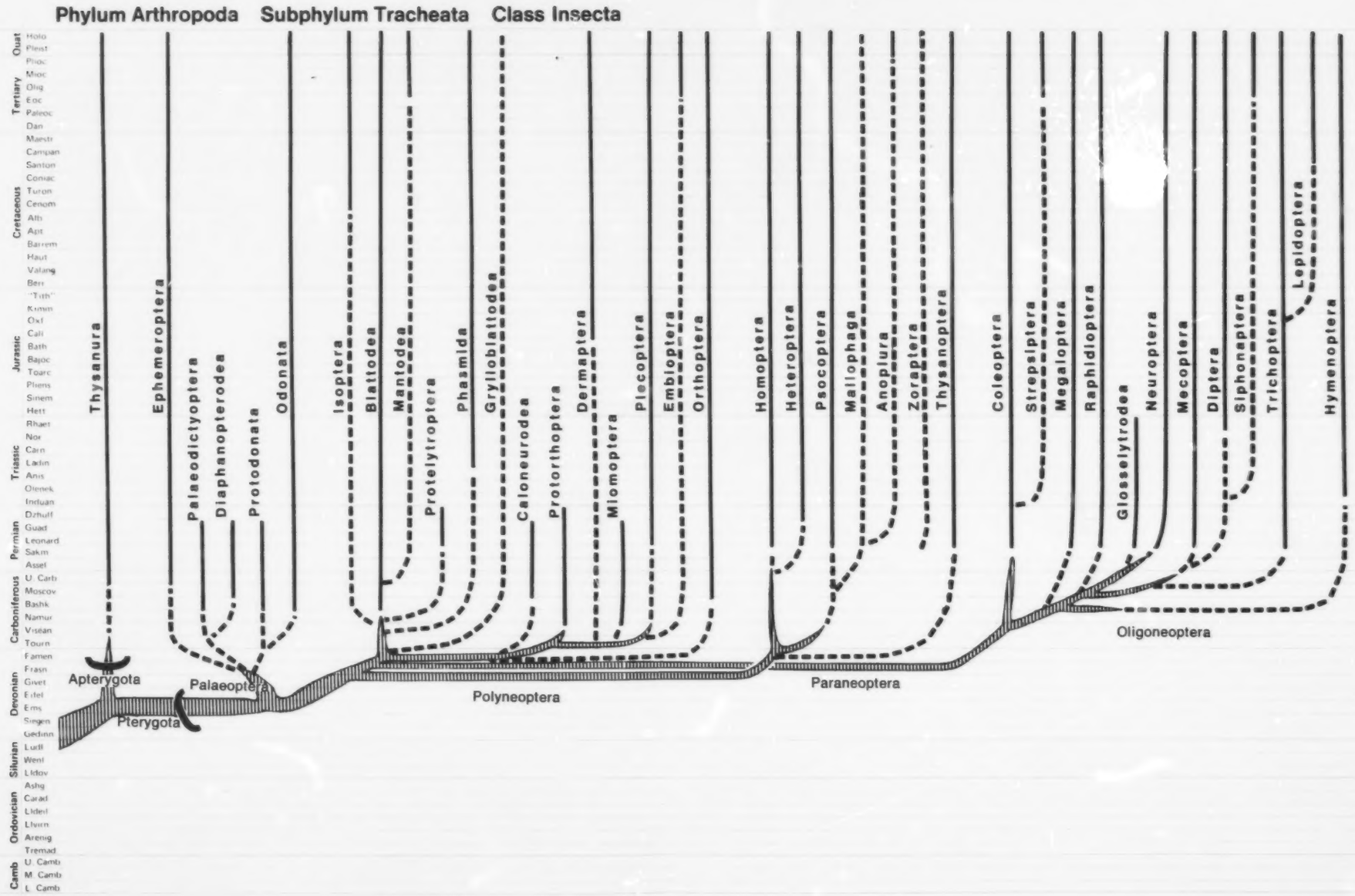

Phylum Arthropoda
Subphylum Tracheata
Class Insecta
Quat
Holo
Pleist
Plioc
Tertiary
Mioc
Olig
Eoc
Paleoc
Cretaceous
Dan
Maestr
Campan
Santon
Coniac
Turon
Cenom
Alb
Apt
Barrem
Haut
Valang
Ber
"Tith"
Jurassic
Kimm
Oxf
Call
Bath
Bajoc
Toarc
Pliens
Sinem
Hett
Triassic
Rhaet
Nor
Carn
Ladin
Anis
Olenek
Induan
Permian
Dzhulf
Guad
Leonard
Sakm
Assel
Carboniferous
U. Carb
Moscov
Bashk
Namur
Visean
Tourn
Famen
Devonian
Frasn
Givet
Eifel
Ems
Siegen
Gedinn
Silurian
Ludl
Wenl
Lldov
Ordovician
Ashg
Carad
Lldel
Llvirn
Arenig
Tremad
Camb
U. Camb
M. Camb
L. Camb
Thysanura
Ephemeroptera
Palaeodictyoptera
Diaphanopterodea
Protodonata
Odonata
Isoptera
Blattodea
Mantodea
Protelytroptera
Phasmida
Grylloblattodea
Caloneurodea
Protorthoptera
Dermaptera
Miomoptera
Plecoptera
Embioptera
Orthoptera
Homoptera
Heteroptera
Psocoptera
Mallophaga
Anoplura
Zoraptera
Thysanoptera
Coleoptera
Strepsiptera
Megaloptera
Raphidioptera
Glosselytrodea
Neuroptera
Mecoptera
Diptera
Siphonaptera
Trichoptera
Lepidoptera
Hymenoptera
Aptérygota
Pterygota
Palaeoptera
Polyneoptera
Paraneoptera
Oligoneoptera

Chart 21/Tableau n° 21 Phylum Bryozoa

Chart 21 / Tableau n° 21

Phylum Bryozoa	
Class Stenolaemata	
Order Cyclostomata	OrdCarad—Rec
Order Cystoporata	Camb U.Camb—PermDzhulf
Order Trepostomata	OrdArenig—PermDzhulf
Order Cryptostomata	OrdLlvirn—TriasOlenek
Class Gymnolaemata	
Order Ctenostomata	OrdArenig—Rec
Order Cheilostomata	CretApt—Rec
Class Phylactolaemata	Rec

Phylum Bryozoa

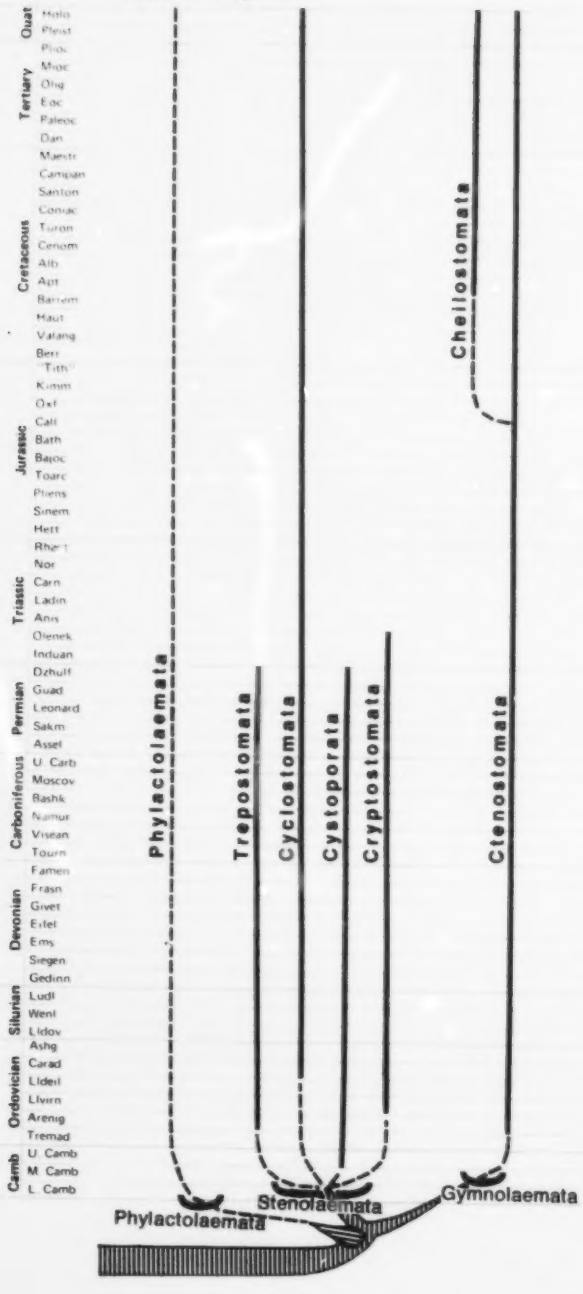


Chart 22/Tableau n° 22 Phylum Brachiopoda

Chart 22/Tableau n° 22

Phylum Brachiopoda

Class Inarticulata	
Order Lingulida	Camb L.Camb—Rec
Order Acrotretida	Camb L.Camb—Rec
Order Obolellida	Camb L.Camb—Camb M.Camb
Order Paterinida	Camb L.Camb—OrdLldeil
Order Kutorginida	Camb L.Camb—Camb M.Camb
Class Articulata	
Order Orthida	Camb L.Camb—PermDzhulf
Order Strophomenida	OrdArenig—Rec
Order Pentamerida	Camb M.Camb—PermDzhulf
Order Rhynchonellida	OrdLlvirn—Rec
Order Spiriferida	SilLldov—JurBajoc
Order Atrypida	OrdLldeil—TriasRhaet
Order Terebratulida	DevGedinn—Rec

Phylum Brachiopoda

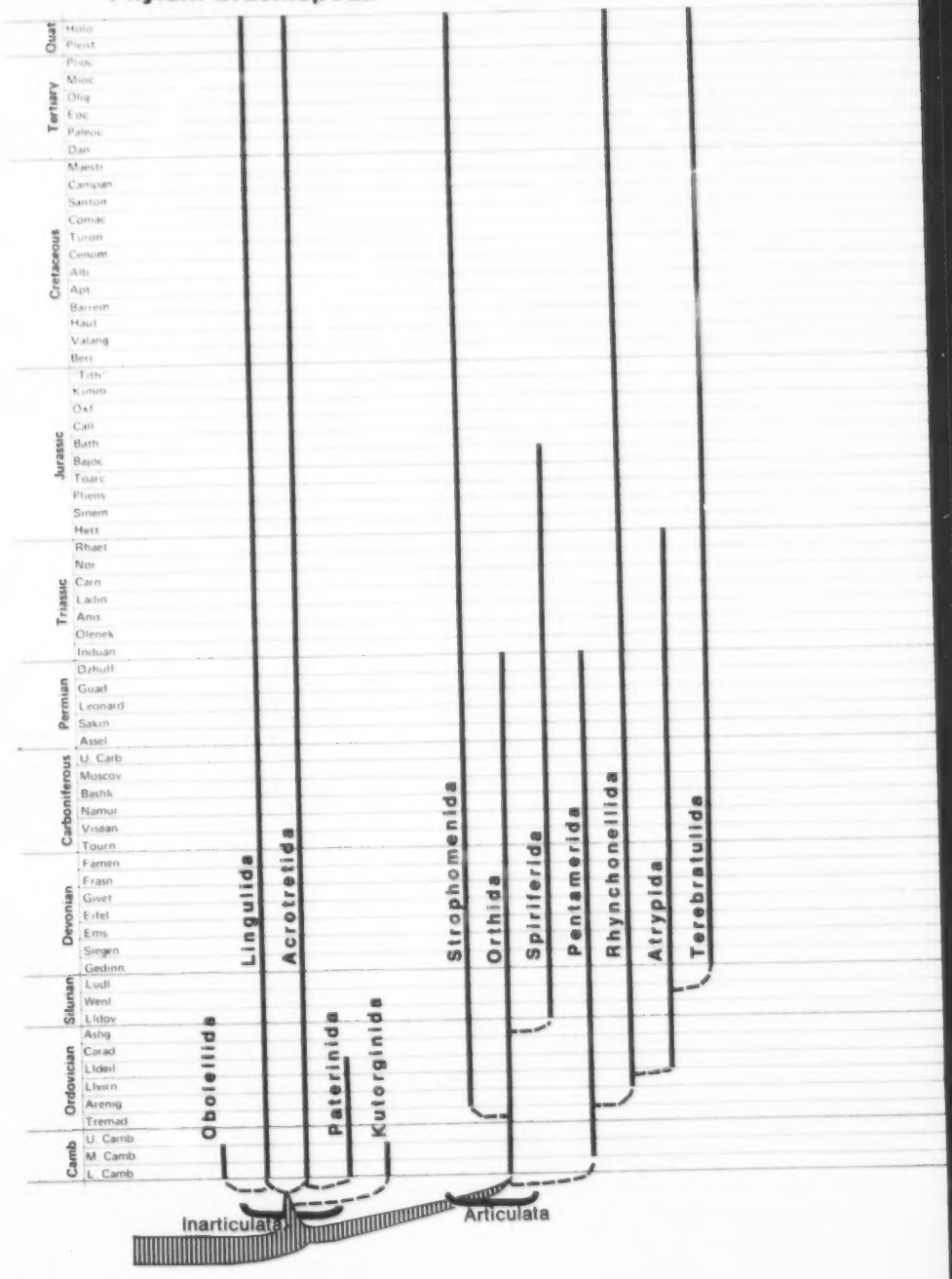


Chart 23/Tableau n° 23 Phylum Echinodermata

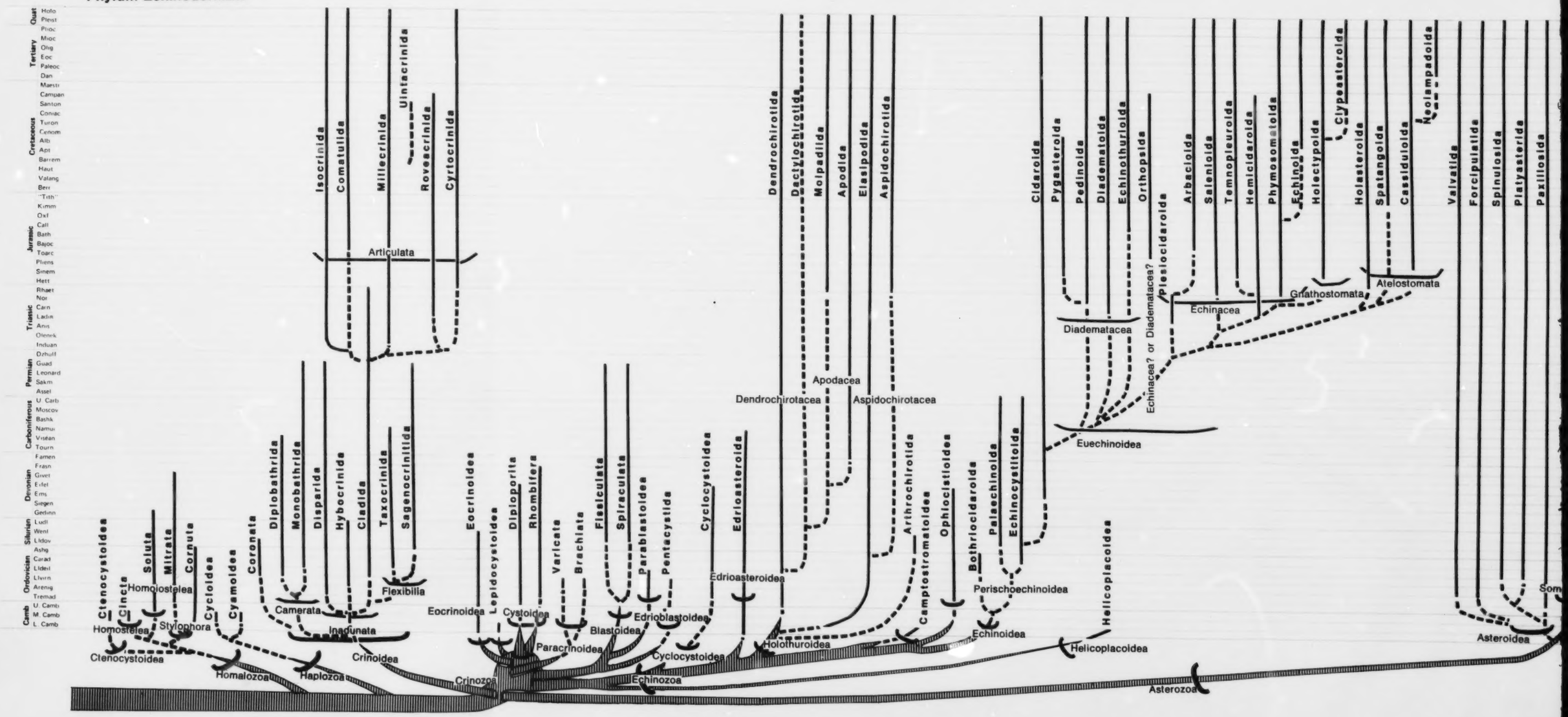
Chart 23/Tableau n° 23

Phylum Echinodermata	
Subphylum Homalozoa	
Class Ctenocystoidea	Camb M.Camb
Class Homoiostelea	
Order Soluta	Camb U.Camb—DevGedinn
Class Homostelea	
Order Cincta	Camb M.Camb
Class Stylophora	
Order Cornuta	Camb M.Camb—OrdAshg
Order Mitrata	OrdTremad—DevGivet
Subphylum Haplozoa	
Class Cycloidea	Camb M.Camb
Class Cyamoidea	Camb M.Camb
Subphylum Crinozoa	
Class Blastoidea	
Order Fissiculata	SilWenl—PermGuad
Order Spiraculata	SilWenl—PermGuad
Class Crinoidea	Camb M.Camb—Rec
Order Coronata	OrdLldeil—SilLudl
Subclass Inadunata	
Order Hybocrinida	OrdLlvirn—SilLudl
Order Disparida	OrdArenig—PermGuad
Order Cladida	OrdLldeil—TriasRhaet
Subclass Flexibilia	
Order Taxocrinida	OrdCarad—CarbNamur
Order Sagenocrinitida	SilLldov—PermGuad
Subclass Camerata	
Order Diplobathrida	OrdLldeil—CarbViséan
Order Monobathrida	OrdCarad—PermGuad
Subclass Articulata	
Order Isocrinida	TriasInduan—Rec
Order Comatulida	JurBajoc—Rec
Order Millecrinida	Trias ?Olenek—Rec
Order Uintacrinida	CretSanton
Order Roveacrinida	TriasCarn—CretCampan
Order Cyrtocrinida	JurHett—Rec
Class Cystoidea	
Order Rhombifera	OrdArenig—DevFrasn
Order Diploporita	OrdTremad—DevEifel
Class Edrioblastoidea	
Order Pentacystida	Ord ?Llvirn
Class Eocrinoidea	Camb L.Camb—SilWenl
Class Parablastoidea	OrdArenig—OrdLldeil
Class Paracrinoidea	
Order Varicata	OrdLlvirn
Order Brachiata	OrdLlvirn
Class Lepidocystoidea	Camb Camb

Subphylum Asterozoa	
Class Stelleroidea	
Subclass Somasteroidea	
Order Goniactinida	OrdTremad—Rec
Subclass Asteroidea	
Order Platyasterida	OrdCarad—Rec
Order Paxillosida	OrdArenig—Rec
Order Valvatida	OrdLlvirn—Rec
Order Spinulosida	OrdCarad—Rec
Order Forcipulatida	OrdLlvirn—Rec
Subclass Ophiuroidea	
Order Stenurida	OrdArenig—DevFrasn
Order Oegophiurida	OrdArenig—Rec
Order Phrynophiurida	DevSiegen—Rec
Order Ophiurida	SilLudl—Rec
Subphylum Echinozoa	
Class Cyclocystoidea	OrdArenig—DevEifel
Class Helicoplacoidea	Camb L.Camb
Class Edrioasteroidea	Camb L.Camb—CarbNamur
Class Ophiocistioidea	OrdArenig—DevEifel
Class Echinoidea	
Subclass Perischoechinoidea	
Order Bothriocidaroida	OrdCarad—OrdAshg
Order Echinocystitoida	OrdAshg—PermAssel
Order Palaechinoida	SilWenl—PermAssel
Order Cidaroida	DevEifel—Rec
Subclass Euechinoidea	
Superorder Diadematacea	
Order Echinothurioida	JurOxf—Rec
Order Diadematoida	Trias ?Nor—Rec
Order Pedinoida	TriasRhaet—Rec
Order Pygasteroida	Jur ?Pliens—Cret ?Cenom
Superorder Echinacea	
Order Salenioida	JurHett—Rec
Order Hemicidaroida	Trias ?Nor—Cret ?Maestr
Order Phymosomatoida	Jur ?Hett—Rec
Order Arbacioida	JurBath—Rec
Order Temnopleuroida	Jur ?Pliens—Rec
Order Echinoida	CretCenom—Rec
Order Plesiocidaroida	TriasCarn
Superorder Echinacea ? or Diadematacea ?	
Order Orthopsida	Jur ?Bajoc—Cret ?Maestr
Superorder Gnathostomata	
Order Holectypoida	JurPliens—Rec
Order Clypeasteroida	CretMaestr—Rec
Superorder Atelostomata	
Order Cassiduloida	JurToarc—Rec
Order Holasteroida	Jur ?Sinem—Rec
Order Spatangoida	CretBerr—Rec
Order Neolampadoida	TertEoc—Rec

Class Holothuroidea	
Subclass Dendrochirotacea	
Order Dendrochirotida	Ord ?Tremad—Rec
Order Dactylochirotida	Rec
Subclass Aspidochirotacea	
Order Aspidochirotida	Jur ?Hett—Rec
Order Elasipodida	Camb M.Camb—Rec
Subclass Apodacea	
Order Apodida	Carb ?Tourn—Rec
Order Molpadiida	Jur ?Hett—Rec
?Subclass	
?Order Arthrochirotida	Dev ?Gedinn
Class Camptostromatoidea	Camb L.Camb

Phylum Echinodermata



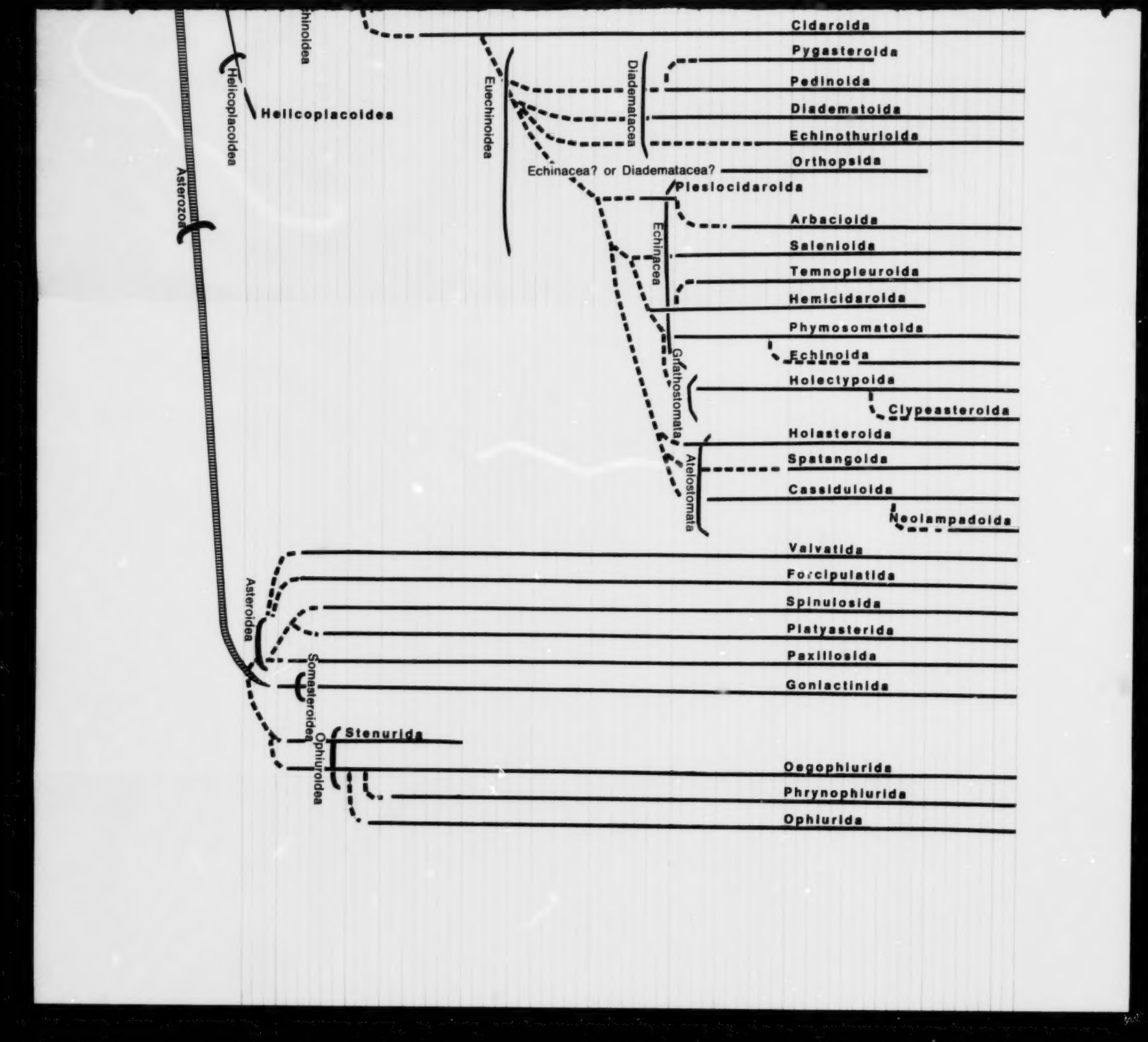

Cidaroida
Pygasteroida
Pedinoida
Diadematoida
Echinothurioida
Orthopsida
Plesiocidaroida
Arbacioida
Salenioida
Temnopleuroida
Hemicidaroida
Phymosomatoida
Echinoida
Holectypoida
Clypeasteroida
Holasteroida
Spatangoida
Cassiduloida
Neolampadoida
Valvatida
Forcipulatida
Spinulosida
Platyasterida
Paxillosida
Goniactinida
Stenurida
Oegophiurida
Phrynophiurida
Ophiurida
Echinacea? or Diadematacea?
Diadematacea
Echinacea
Euechinoidea
Helicoplacoidea
Asterozoa
Asteroidea
Somasteroidea
Ophiuroidea

Chart 24/Tableau n° 24 Phylum Pogonophora

Chart 24/Tableau n° 24

Phylum Pogonophora

Order Sabelliditida	Camb L.Camb
Order Hyolithelminthes	Camb L.Camb—Camb M.Camb
Order Thecanephria	Rec
Order Athecanephria	Rec

Phylum Pogonophora

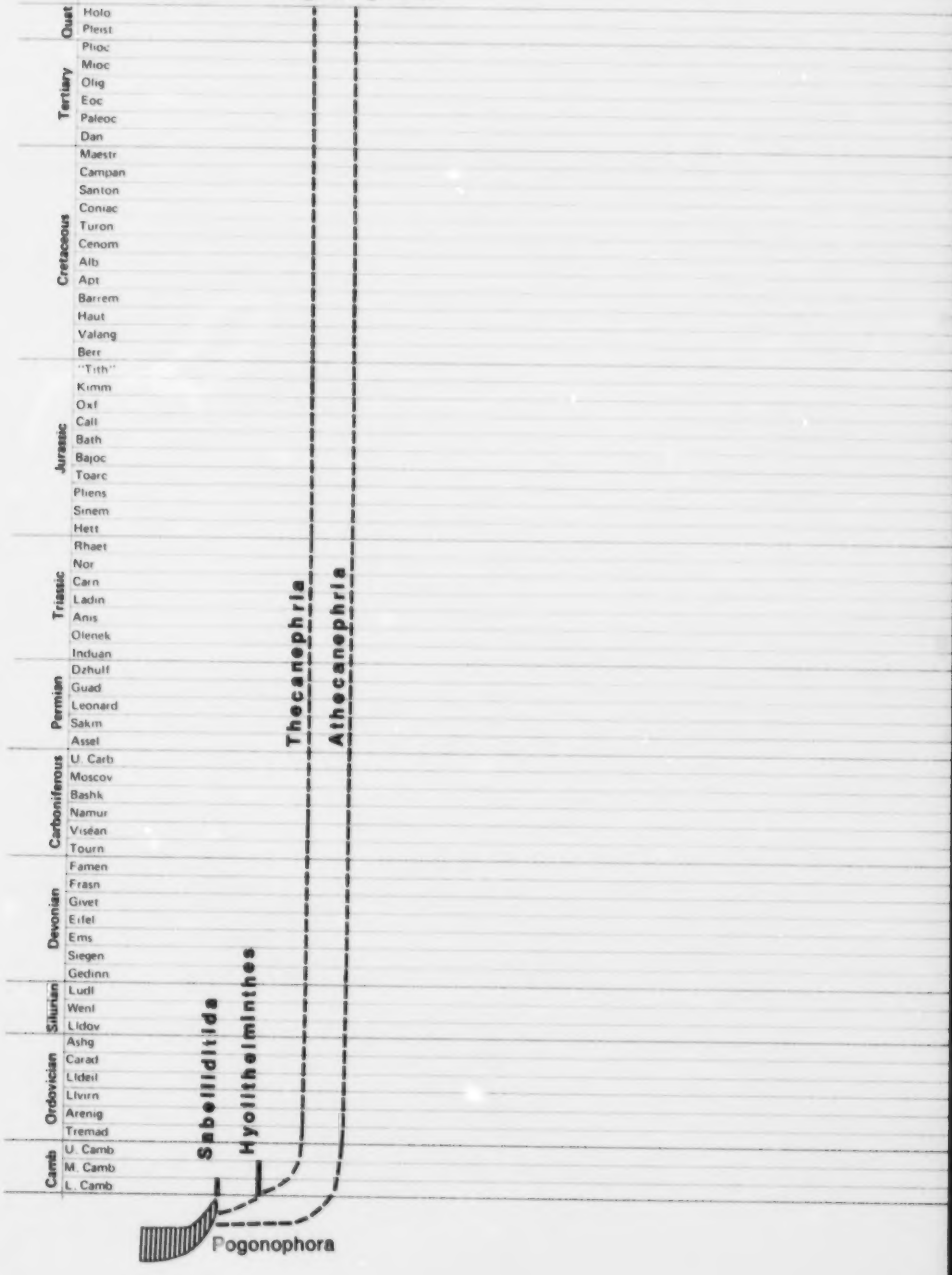


Chart 25/Tableau n° 25 Phylum Hemichordata

Chart 25/Tableau n° 25

Phylum Hemichordata	
Class Graptolithina	
Order Dendroidea	Camb ?M.Camb—Camb U.Camb—CarbNamur
Order Tuboidea	Camb ?U.Camb—OrdTremad—SilWenl
Order Camaroidea	OrdTremad
Order Stolonoidea	OrdTremad—OrdCarad
Order Crustoidea	OrdArenig—OrdLldeil
Order Graptoloidea	OrdArenig—DevEms
Suborder Didymograptina	OrdArenig—OrdAshg
Suborder Glossograptina	OrdLlvirn—OrdAshg
Suborder Diplograptina	OrdLlvirn—SilLudl
Suborder Monograptina	SilLldov—DevEms
Class Graptolithina Incertae Sedis *(not included/exclue)*	
Group Graptoblasti	OrdTremad—OrdLldeil
Group Acanthastida	OrdTremad
Group Graptovermida	OrdTremad
Class Pterobranchia	
Order Rhabdopleurida	OrdTremad—Rec
Order Cephalodiscida	OrdTremad—Rec
Class Enteropneusta	Rec
Class Planctosphaeroidea *(not included/exclue)*	Rec

Phylum Hemichordata

Chart 26 Phylum Chordata Stem Graph Fish-like Vertebrates
Tableau n° 26 Phylum Chordata Ramifications principales Vertébrés pisciformes

Chart 26/Tableau n° 26

Phylum Chordata Stem Graph Fish-like Vertebrates
Ramifications principales Vertébrés pisciformes

Subphylum Urochordata	Rec
Subphylum Cephalochordata (Acrania)	Rec
Subphylum Craniata (Vertebrata)	
Divisio Agnatha	
Class Monorhina	
Superorder Mixini	Rec
Superorder Petromyzonida	CarbBashk—Rec
Superorder Anaspida	SilWenl—DevFrasn
Superorder Osteostraci	SilLldov—DevFrasn
Superorder Galeaspida	DevSiegen
Class Diplorhina	
Superorder Heterostraci	OrdCarad—DevFrasn
Superorder Thelodonti	SilLudl—DevEifel
Divisio Gnathostomata	
Class Placodermi	DevGedinn—CarbTourn
Class Acanthodii	SilLldov—PermLeonard
Class Holocephali	CarbTourn—Rec
Class Elasmobranchii	DevEms—Rec
Superclass Osteichthyes	
Class Actinopterygii	
Subclass Chondrostei	DevGivet—Rec
Subclass Holostei	PermDzhulf—Rec
Subclass Teleostei	JurTith—Rec
Class Dipneusti	DevSiegen—Rec
Class Crossopterygii	
Subclass Coelacanthi	DevGivet—Rec
Subclass Rhipidistia	DevSiegen—PermAssel

Phylum Chordata stem graph–Fish-like vertebrates

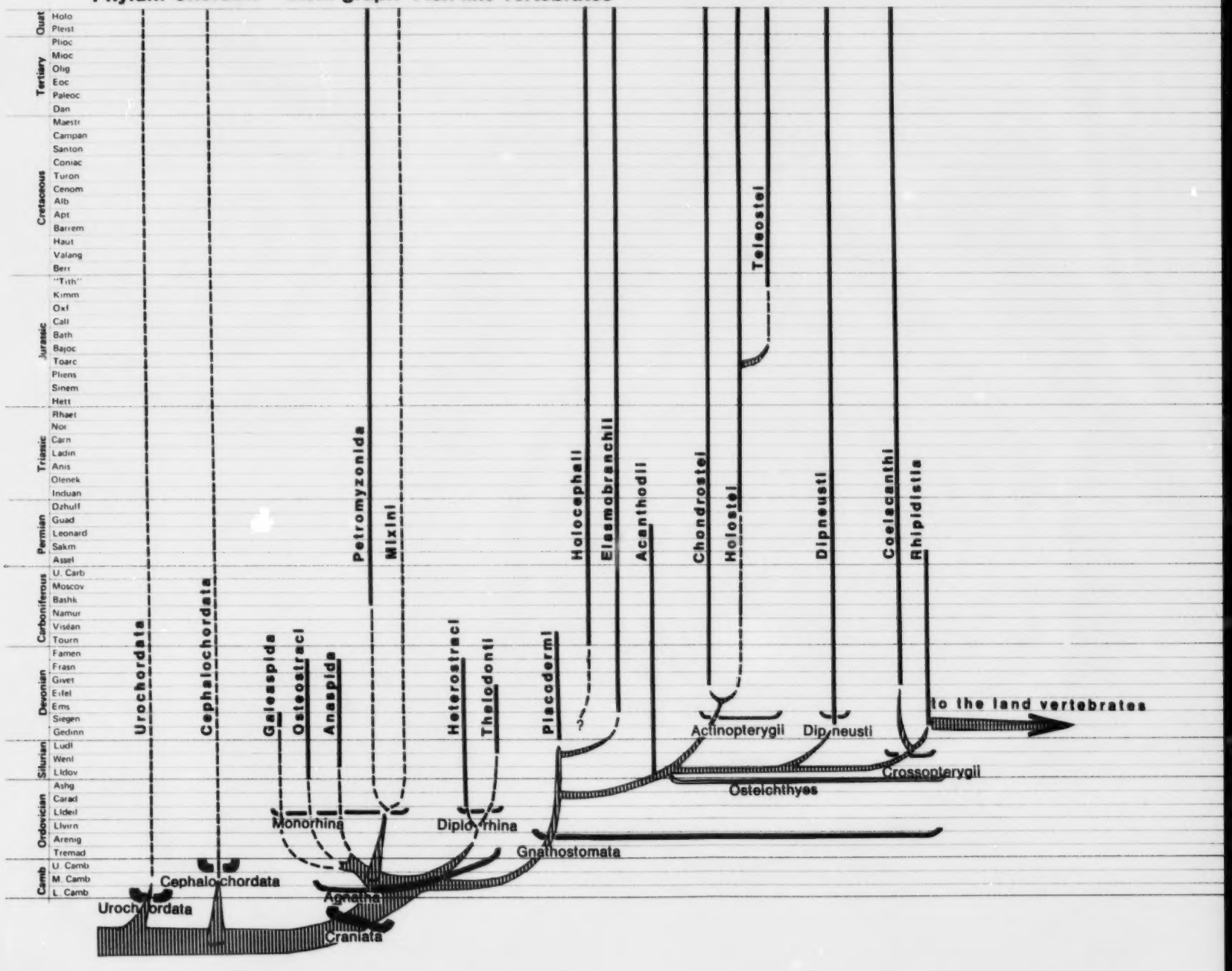


Chart 27/Tableau n° 27 Phylum Chordata Class Amphibia

Chart 27/Tableau n° 27

Phylum Chordata Class Amphibia

Subclass Labyrinthodontia	
Order Ichthyostegalia	DevFamen—CarbTourn
Order Temnospondyli	CarbViséan—TriasRhaet
Order Plagiosauria	PermDzhulf—TriasRhaet
Order Anthracosauria	CarbViséan—PermDzhulf
Subclass Lepospondyli	
Order Aistopoda	CarbViséan—PermLeonard
Order Nectridia	CarbBashk—PermLeonard
Order Microsauria	CarbViséan—PermLeonard
Order Lysorophia	CarbMoscov—PermLeonard
Subclass Lissamphibia	
Order Anura	TriasInduan—Rec
Order Urodela	CretBerr—Rec
Order Apoda	TertPaleoc—Rec

Phylum Chordata Class Amphibia

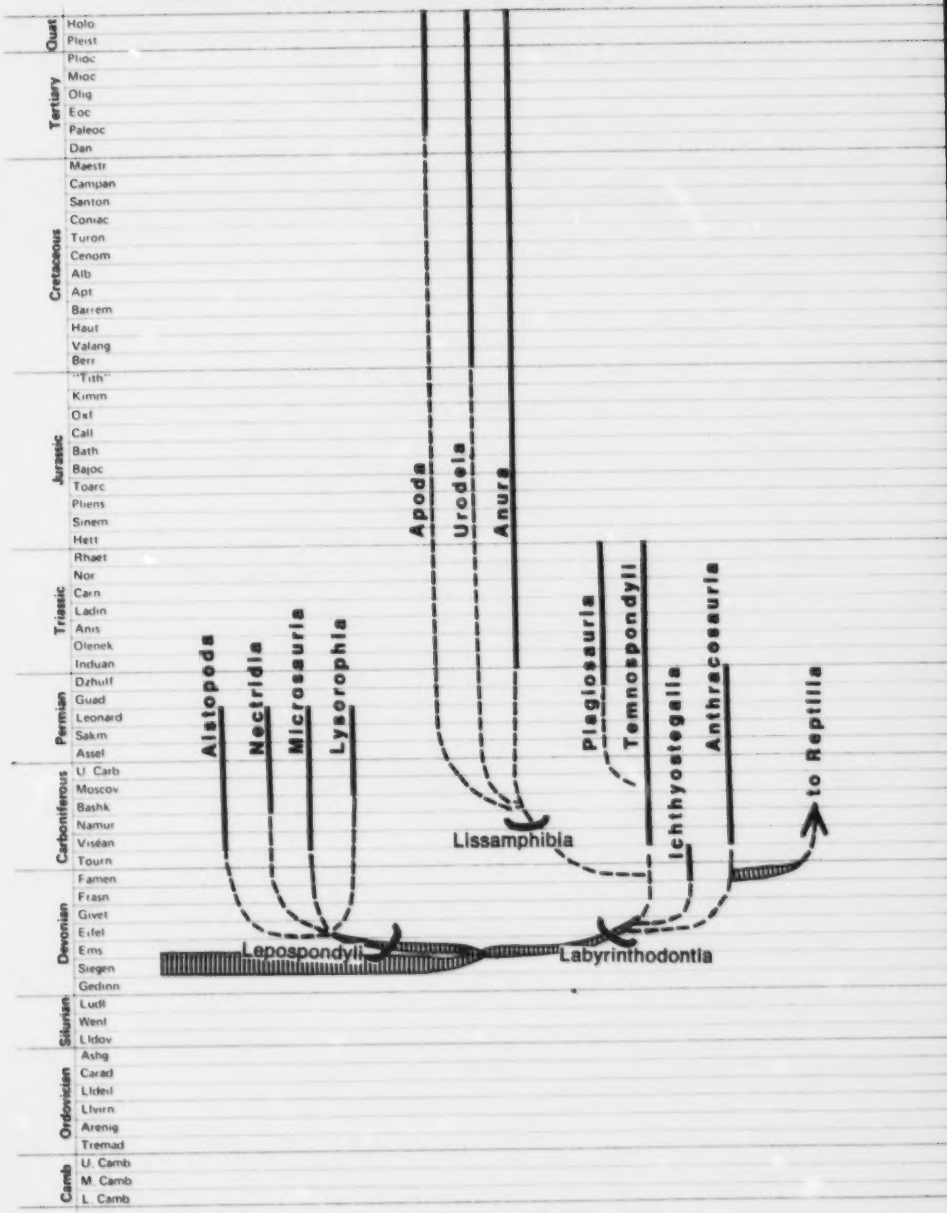


Chart 28/Tableau n° 28 Phylum Chordata Class Reptilia

Chart 28/Tableau n° 28

Phylum Chordata Class Reptilia

Subclass Anapsida	
Order Captorhinomorpha	CarbBashk—PermLeonard
Order Chelonia	TriasNor—Rec
Subclass Archosauria	
Order Thecodontia	PermDzhulf—TriasRhaet
Order Crocodilia	TriasCarn—Rec
Order Saurischia	TriasLadin—CretMaestr
Order Ornithischia	TriasCarn—CretMaestr
Order Pterosauria	JurSinem—CretSanton
Subclass Lepidosauria	
Order Eosuchia	PermGuad—TriasLadin
Order Rhynchocephalia	TriasInduan—Rec
Order Squamata	TriasNor—Rec
Subclass Synapsida	
Order Pelycosauria	CarbBashk—PermGuad
Order Therapsida	PermGuad—JurBath
Subclass Sauropterygia	
Order Nothosauria	TriasInduan—TriasCarn
Order Plesiosauria	TriasLadin—CretMaestr
Subclass Placodontia	
Order Placodontia	TriasOlenek—TriasRhaet
Subclass Ichthyopterygia	
Order Ichthyosauria	TriasOlenek—CretMaestr
Subclass?	
Order Procolophonia	PermGuad—TriasNor

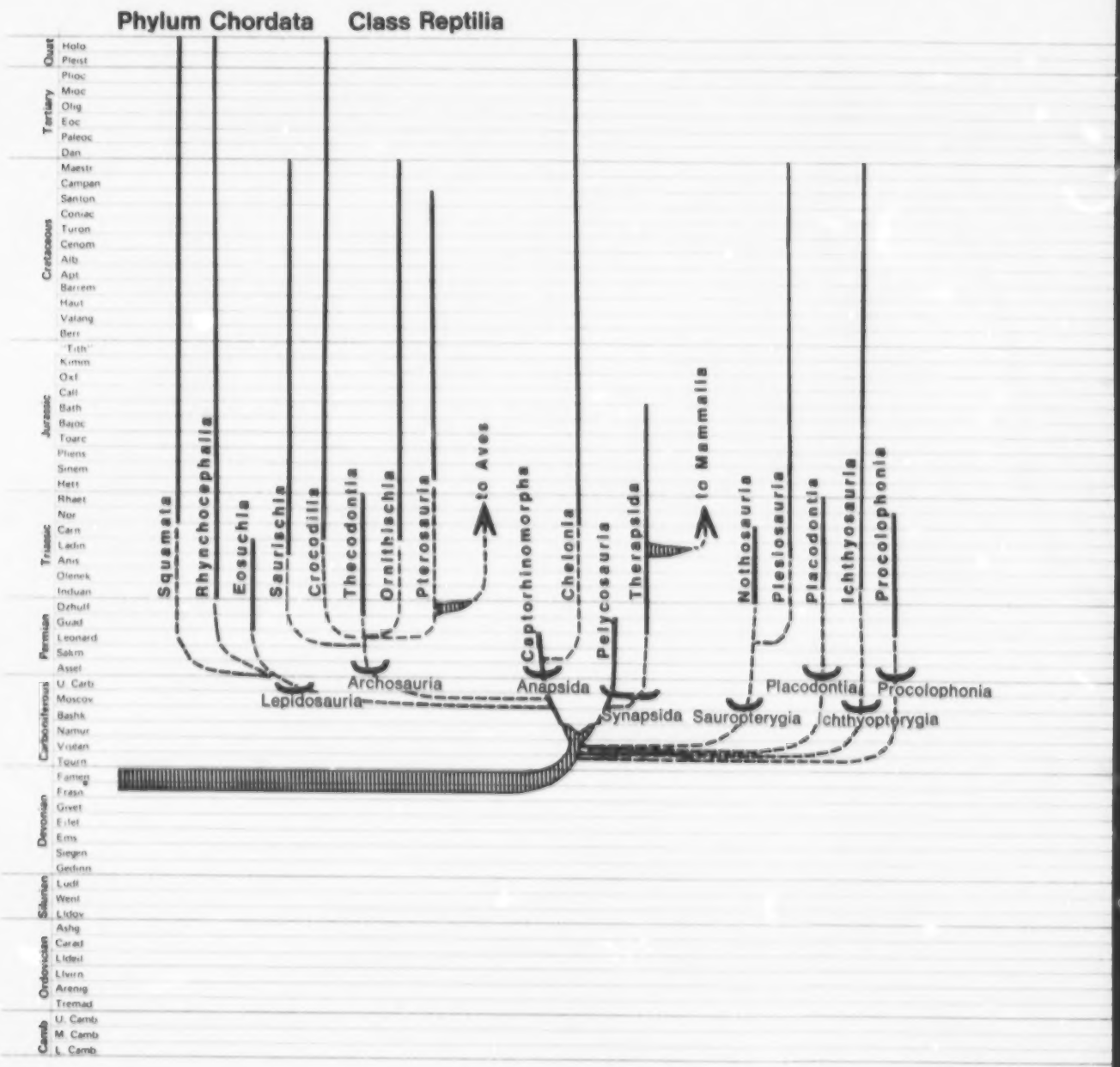

Phylum Chordata
Class Reptilia
Quat
Holo
Pleist
Tertiary
Plioc
Mioc
Olig
Eoc
Paleoc
Dan
Cretaceous
Maestr
Campan
Santon
Coniac
Turon
Cenom
Alb
Apt
Barrem
Haut
Valang
Berr
Jurassic
"Tith"
Kimm
Oxf
Call
Bath
Bajoc
Toarc
Pliens
Sinem
Hett
Triassic
Rhaet
Nor
Carn
Ladin
Anis
Olenek
Induan
Permian
Dzhulf
Guad
Leonard
Sakm
Asset
Carboniferous
U. Carb
Moscov
Bashk
Namur
Visean
Tourn
Devonian
Famen
Frasn
Givet
Eifel
Ems
Siegen
Gedinn
Silurian
Ludl
Wenl
Lldov
Ordovician
Ashg
Carad
Lldvl
Llvirn
Arenig
Tremad
Camb
U. Camb
M. Camb
L. Camb
Squamata
Rhynchocephalia
Eosuchia
Saurischia
Crocodilia
Thecodontia
Ornithischia
Pterosauria
to Aves
Captorhinomorpha
Chelonia
Pelycosauria
Therapsida
to Mammalia
Nothosauria
Plesiosauria
Placodontia
Ichthyosauria
Procolophonia
Lepidosauria
Archosauria
Anapsida
Synapsida
Placodontia
Procolophonia
Sauropterygia
Ichthyopterygia

Chart 29/Tableau n° 29 Phylum Chordata Class Aves

Chart 29/Tableau n° 29

Phylum Chordata Class Aves

Subclass Sauriurae	
Order Archaeopterygiformes	JurTith
Subclass Odontoholcae	
Order Hesperornithiformes	CretConiac—CretCampan
Subclass Ornithurae	
Superorder Ratitae	
Order Rheiformes	TertEoc—Rec
Order Struthioniformes	TertEoc—Rec
Order Aepyornithiformes	TertEoc—Rec
Order Casuariiformes	TertPlioc—Rec
Order Dinornithiformes	TertPlioc—Rec
Order Apterygiformes	QuatPleist—Rec
Superorder Dromaeognathae	
Order Tinamiformes	TertPlioc—Rec
Superorder Carinatae	
Order Gaviiformes	CretAlb—Rec
Order Podicipediformes	CretConiac—Rec
Order Sphenisciformes	TertEoc—Rec
Order Procellariiformes	TertEoc—Rec
Order Pelecaniformes	CretMaestr—Rec
Order Ardeiformes	CretValang—Rec
Order Anseriformes	TertEoc—Rec
Order Accipitriformes	TertDan—Rec
Order Ichthyornithiformes	CretConiac
Order Galliformes	TertEoc—Rec
Order Ralliformes	CretMaestr—Rec
Order Charadriiformes	CretMaestr—Rec
Order Columbiformes	TertEoc—Rec
Order Cuculiformes	TertEoc—Rec
Order Psittaciformes	TertMioc—Rec
Order Strigiformes	TertEoc—Rec
Order Caprimulgiformes	TertEoc—Rec
Order Coraciiformes	TertEoc—Rec
Order Trogoniformes	TertEoc—Rec
Order Coliiformes	TertMioc—Rec
Order Apodiformes	TertEoc—Rec
Order Piciformes	TertEoc—Rec
Order Passeriformes	TertEoc—Rec

This graph was prepared by Dr. P. Brodkorb in May 1972.
M. P. Brodkorb a préparé ce tableau, en mai 1972.

Phylum Chordata Class Aves

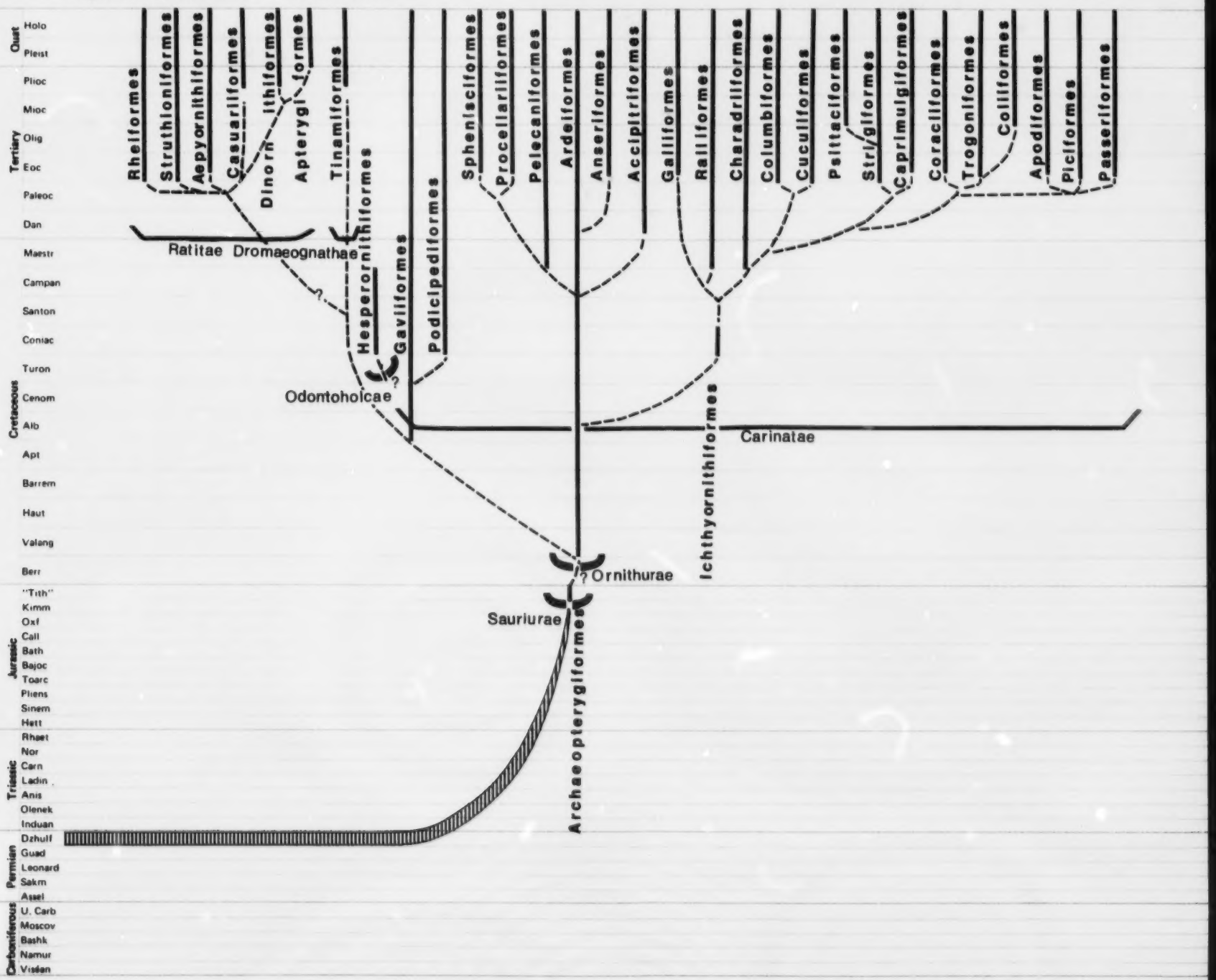
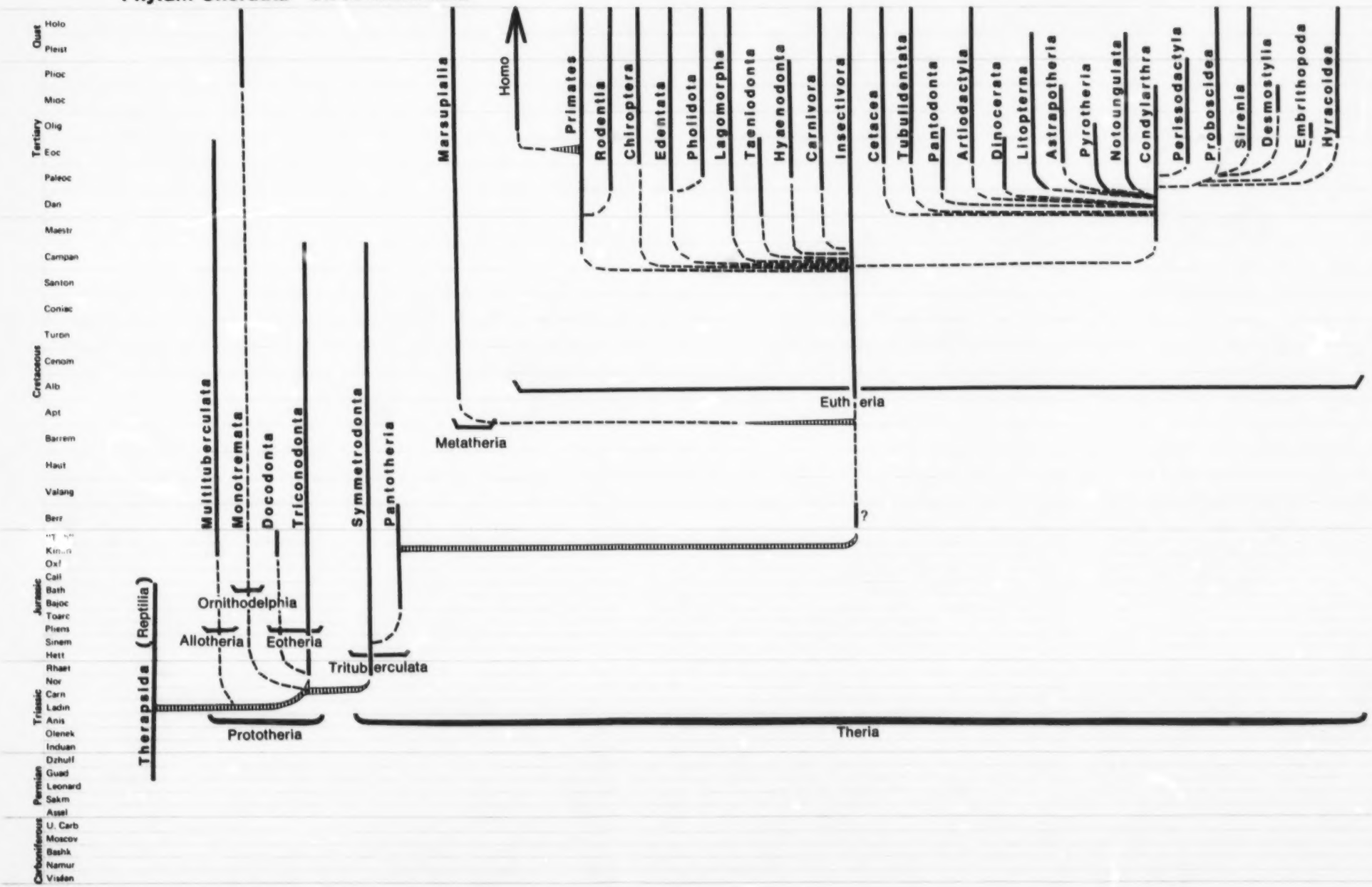


Chart 30/Tableau n° 30

Phylum Chordata Class Mammalia

Subclass Prototheria	
Infraclass Eotheria	
Order Triconodonta	TriasRhaet—CretCampan
Order Docodonta	JurKimm—JurTith
Infraclass Ornithodelphia	
Order Monotremata	TertPlioc—Rec
Infraclass Allotheria	
Order Multituberculata	JurKimm—TertEoc
Subclass Theria	
Infraclass Trituberculata	
Order Symmetrodonta	TriasRhaet—CretCampan
Order Pantotheria	JurBajoc—CretBerr
Infraclass Metatheria	
Order Marsupialia	CretAlb—Rec
Infraclass Eutheria	
Order Insectivora	CretAlb—Rec
Order Primates	CretMaestr—Rec
Order Rodentia	TertPaleoc—Rec
Order Chiroptera	TertEoc—Rec
Order Edentata	TertPaleoc—Rec
Order Pholidota	TertPaleoc—Rec
Order Lagomorpha	TertPaleoc—Rec
Order Taeniodonta	TertDan—TertEoc
Order Hyaenodonta	TertPaleoc—TertPlioc
Order Carnivora	TertPaleoc—Rec
Order Condylarthra	CretMaestr—TertMioc
Order Cetacea	TertEoc—Rec
Order Tubulidentata	TertEoc—Rec
Order Pantodonta	TertPaleoc—TertOlig
Order Artiodactyla	TertEoc—Rec
Order Dinocerata	TertPaleoc—TertEoc
Order Litopterna	TertPaleoc—QuatPleist
Order Astrapotheria	TertEoc—TertMioc
Order Pyrotheria	TertPaleoc—TertOlig
Order Notoungulata	TertPaleoc—QuatPleist
Order Perissodactyla	TertEoc—Rec
Order Proboscidea	TertEoc—Rec
Order Sirenia	TertEoc—Rec
Order Desmostylia	TertMioc
Order Embrithopoda	TertOlig
Order Hyracoidea	TertOlig—Rec

Phylum Chordata Class Mammalia